SCIENTIFIC AMERICAN

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View from the S.S. "Trent" of the "America" as it was being lowered preparatory to launching the lifeboat. The balloon was making 15 knots broadside to the wind.

STORY OF THE WELLMAN OCEAN AIR TRIP.—[See page 340.]

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NEW YORK, SATURDAY, OCTOBER 29th, 1910.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

CHIEF ENGINEER VANIMAN ON THE AIRSHIP CRUISE.

LAST week we gave some impressions of a talk with Moisant, famous for his flight from Paris to London, and this week we are able to give similar impressions of Vaniman, the designer and constructor of the Wellman dirigible, which last week broke the record for distance and duration in the air in the course of an attempted flight over the Atlantic, which for absolute novelty and dramatic interest is without a precedent in the annals of aviation. In comparing Moisant and Vaniman we use the term "similar impressions" advisedly; for the airman of the dirigible is possessed of the same virility, ambition, and intelligent daring which we noted in Moisant. In this matter of "air conquest," it would almost seem as though there were some principle of natural attraction or selection which brings the right man and the task together. Our talk of two hours deepened the impression that, while both Wellman and Vaniman were alive to the multiplied difficulties and hazards of the undertaking, they had endeavored, in a very intelligent way, to make proper provision for meeting all contingencies, at least as far as they could be foreseen.

In view of the rough experiences through which these would-be trans-Atlantic aerial voyagers passed, it will doubtless surprise our readers to learn that Vaniman is far from being discouraged by the failure, which he attributes to the breakdown of his 90-horse-power elevating engine. Had this engine been in operation on that stormy Sunday night, he is convinced he could have prevented the perilous downward surging of the balloon to the surface of the water. It would not have been necessary to jettison the invaluable gasoline; and with a reasonable amount of favoring wind, he believes that there would be a good fighting chance to get across.

Asked as to whether the equilibrator lashed viciously from wave to wave, jerking and threatening to break asunder the car and the balloon, Vaniman emphatically stated that there was no trouble whatever from this source. The jarring and wrenching was never serious at any time. "In fact," he said, "when we abandoned the ship, with the exception of a broken-down motor, she was perfectly sound in every part, with not a joint in the steel framework or a seam in the gas bag started." "Furthermore," said he, "I wish you to tell the public that so far from the equilibrator being a failure, it was this very element in the design that saved the ship; for without ballast aboard, in our descent from the altitude of several thousand feet, to which we were carried by the expansion due to the heat of the sun, we must have struck the sea with such velocity as to have instantly wrecked the balloon and lost all on board. The equilibrator, weighing some two tons, as it gradually floated on the sea with the descent of the balloon, acted as a cushion or buffer, or, to be more accurate, as an *equilibrator*, and arrested the downward velocity, the load being gradually relieved by the buoyancy of the water, and the dirigible brought to a condition of equilibrium before it reached the sea."

It was the action and reaction of the forces represented by the pressure of the wind, the drag of the equilibrator, and the buoyancy of the balloon, that caused the huge fabric, during the storm, to take a wave-like course through the air, alternately rising and lifting its two-ton equilibrator clear of the water, and then swinging down until the lifeboat was splashed by the waves below. Now it had been Vaniman's plan, in such an emergency, to swing the two propellers of the after motor into the horizontal position and check this downward motion by driving them at full speed, when they would have exerted a downward thrust of some 800 pounds. Unfortunately, after being four hours in service, because of the absence of a flywheel, the back lash of the motors had caused the keys which held the bevel gears at the outer ends of the crank shaft to slip, thereby putting the whole plant out of commission. During the storm of Sunday night, when the stronger gusts hit the large surface of the dirigible, which, by the way, had swung across square to the wind, the resultant of the heavy wind pressure and the pull of the equilibrator bore the vessel down toward the water, until the anxious voyagers could see the surface sweeping past, not many feet below, at a speed estimated at from 25 to 30 miles an hour. Had the life boat been immersed, it would have been lifted from its shackles and lost. Therefore, to lighten the vessel, the disabled motor and much of the gasoline was thrown overboard—a sacrifice which destroyed the last hope of getting across to the eastward.

As to the practical results of the expedition, Vaniman claims that they are well worth the risk that was run. If, as he hopes, the day is coming when the perfected dirigible will cross the Atlantic, he believes that the experience gained during this thousand miles of travel will be invaluable and a distinct asset to the art of airship navigation.

As to the possibility of making the crossing by carrying the dirigible to a height of three or four miles, where prevailing westerly winds of 30 to 40 miles are to be found, Vaniman believes that it would be impossible, for the reason that sufficient ballast could not be carried to maintain the ship at the necessary elevation. The alternate expansion by day and contraction by night, he claims, would necessitate a loss of gas and the carrying of an amount of ballast that would render the passage impracticable. He still believes that should the trip ever be made, it will have to be made near the surface of the sea, and under the control of an improved equilibrator of the general type which he has used.

FORESTS IN RELATION TO CLIMATE AND FLOODS.

THE drying up of streams, the failure of wells, and the exhaustion of reservoirs as a result of the present exceptionally prolonged drought, with all its attendant personal discomforts, have directed attention to the important question as to how far these conditions are due to the cutting away of those primeval forests which once so densely covered large sections of the United States. For it is popularly believed that there is an intimate relation of cause and effect between the denudation of our forests and the supposed decrease of rainfall and increase in the severity and number of the floods during rainy seasons.

There has recently been issued from the Government Printing Office at Washington a report by Willis L. Moore, chief of the Weather Bureau, on the "Influence of Forests on Climate and Floods," in which the astounding fact is stated, and proved by statistics, that, so far as the records of this bureau throw light upon the subject, forests have no effect either upon the amount of rainfall, or upon the severity of floods. The report is rendered the more significant by Mr. Moore's statement at the outset that he himself originally believed that the cutting away of forests to some extent affected the flow of streams, and that it is the careful study of his own and other records of rainfall and floods that has caused him to change his opinion.

The records of precipitation of the United States Weather Bureau fail to show any appreciable permanent decrease in the rainfall of any section of the United States. One of the best and longest records of precipitation is that made at New Bedford, Mass., by Mr. Samuel Rodman and his son, covering the period from 1814 to 1908; and an investigation of this shows that for the first fifty years, from 1814 to 1864, the average annual rainfall at that point was about 46 inches, while during the last 45 years the annual fall has increased to more than 47 inches. This indicates that in spite of the deforestation which has taken place there has been a slight increase, rather than the supposed decrease in precipitation.

Mr. Moore states that he has always held to the opinion that the denudation of forests has had little or no appreciable effect on the amount of precipitation; but that until recent years he believed that deforestation did affect the run-off of the water. Study and investigation, he says, have caused him to modify his views, and he quotes Professor Abbe, as stating that the cultivated soil outside the forest, when plowed and broken open down to a depth of eight inches, acts as a sponge to retain water quite as well as does the ordinary humus of a forest. While foresters believe that the forests conserve precipitation and restrain floods, army and civilian engineers and meteorologists believe that the cultivated, permeable soil is as good a conserver of the rainfall as the forest area itself. It is probable that forests have little to do with the height of floods in main tributaries and principal streams; the true cause of these floods is the continuance of heavy rain after the ground has everywhere been saturated, or when heavy warm rains come on the top of deep snows.

The studies of French engineers, based upon centuries of observation in the Seine valley, have led them to the conviction that forests have little to do with floods. Thus, measurements of the discharge of the Coulsin and the Grenedierre, one of which flows in a basin which is about one-third wooded, while the basin of the other is entirely covered with trees, shows that the results as regards run-off, etc., are identical. Furthermore, observations made by competent engineers during two and one-half centuries in the basin of the Seine prove that in spite of the diminution of forests, there has been a gradual and constant decrease in the average height of floods. The chief of the Hydrographic Bureau of the Austrian government, recently traced the history of the floods of the Danube for eight hundred years, and his conclusions are that progressive deforestation of the country has had no effect in increasing the frequency, or augmenting the height of the floods.

That the records of precipitation show it to be so permanent in quantity will be no matter for surprise, if we realize that its source is the aqueous vapor that is raised from the vast waters to the south and southeast of our continent—a supply which is inexhaustible. Our rainfall is dependent, then, on such vast and permanent sources that it cannot be appreciably affected by the planting or cutting away of forests, or by any of the works of man which affect the condition of the surface of the continent.

In considering the question as to whether floods are increasing in this country, Mr. Moore gives a table of the rainfall at Chattanooga and Knoxville separately, for the months December to May, from 1883 to 1907, and he finds that the total number of heavy rains at these points during the first twelve years of this period, was 210, and during the second twelve years, was 192. The total number of days which showed river stages of 20 feet or more at Chattanooga during the first period, was 166, while the total number during the second period was only 141; and other figures are presented which show that an equal depth of rain in the last period did not produce more severe floods in the river than it did in the first period.

The most convincing figures given by Mr. Moore, however, are those regarding the rainfall and run-off of the Ohio basin. He states that we have no direct method of measuring the run-offs, but we can reach a fair approximation to it by comparison of the rainfall and the height of the river for any given watershed. If the surface conditions of a watershed have been changed by deforestation, and if cutting away the forests has caused a rapid flow of the surface water into the streams, then the height of the floods should be greater for an equal fall of rain, or depth of precipitation. Cincinnati, Ohio, was taken for the comparison, which is based on the mean river stages of the Ohio River from 1871 to 1908. From 1871 to 1889, the mean annual river stage was 17.3 feet; from 1890 to 1908, it was 17.6 feet; from 1871 to 1908, it was 17.4 feet.

Now the annual precipitation for the same period shows that the mean from 1871 to 1889 was 41.3 inches, and from 1890 to 1908, 41.8 inches. These figures show perfect agreement between the precipitation and the flow of the stream, and they certainly would seem to prove that such deforestation as has taken place in the basin of the Ohio has had no appreciable effect on the flow of the river.

Finally, to determine whether real flood stages are more numerous than formerly, records were examined of the Cumberland, the Tennessee, and the Ohio rivers, to show the number of days in each year the rivers were at, or above, flood stage, and it was found that from 1879 to 1903, there were 2,073 such days, and from 1894 to 1908, there were only 1,370, an excess per year of 46.9 days for the earlier period.

Mr. Moore's attitude to the question of deforestation is given in the following extract from his report:

"In every country the general tendency, with growth of population, is to convert forest lands into cultivated fields, and this tendency should not be discouraged unless it can be shown that deforestation has augmented droughts and floods, and I believe that it cannot be shown. I believe that forests should be preserved for themselves alone or not at all; . . . there can be no valid objection to decreasing the area where homes and a well-fed people take the place of wild animals and wilderness."

Hundreds of carats of diamonds have been registered from a property in the Pretoria district, ten miles from the Premier Diamond Mine, and it is generally believed that a very large mine has been discovered. A great deal of prospecting is being done north of Pretoria, and several interests have been acquired in the neighborhood by an important firm of Johannesburg speculators. The immediate outlook for the Transvaal mining industry is stated to be decidedly promising.

ENGINEERING.

The committee recently appointed by the Interstate Commerce Commission, consisting of fifteen representatives of the railroad commission and the operatives, has determined on definite standards of safety appliances to be attached to railway cars and locomotives. It is estimated that the proposed changes in equipment will cost the railroads about $50,000,000.

That the cross-tie industry makes a heavy demand upon our timber supplies is shown by the records of the present census. In 1909 the total number of cross-ties of all kinds reported as having been purchased was 123,754,000, costing at the point of purchase, $60,-321,000. These purchases were for steam and electric railroads, and of the total amount 93 per cent was used by the steam roads. From 40 to 46 per cent of ties are of oak, and of late years there has been a marked increase in the use of gum and beech woods.

The monorail car, running between Bartow and City Island, New York, which met with an accident on the first day of its operation three months ago, has been rebuilt, and the road, which has been carrying passengers experimentally for some weeks, hopes shortly to commence regular service under a new franchise. The car is carried on two trucks on a single rail, and is supported by a strong trolley running on a rigid overhead rail supported from standards placed on the side of the track.

Emulating the recent long-distance trip of the United States submarine "Salmon" from Provincetown to Bermuda and back, the French submarine boat "Archimede" has accomplished a non-stop voyage from Cherbourg to the mouth of the River Gironde and back, a distance of 1,625 miles, in less than five days. The vessel is a large craft, containing four officers' cabins and accommodations for a crew of thirty-two men. The French officers claim that she provides as much comfort as can be found on a torpedo-boat destroyer.

Prof. William H. Goodyear, writing in the American Architect, makes an analysis of the recent report of the commission on the leaning tower of Pisa, in which he proves that there has been no increase in its inclination since the authoritative observation of M. De Fleury in 1859. He considers that the tower is in no danger of falling. It seems that the computations of the recent report were based on knowledge obtained at second-hand, which contained important errors as to the observations taken in 1829; these errors vitiating, of course, the computations of the present commission.

Apparently, engineer officers of our navy are most favorably impressed with oil fuel, and this as the result of their practical experience on ships that are equipped for its use. Lieut. Com. Allen of the "Nebraska" estimates that weight for weight, fuel oil will carry his ship one-third farther than coal and at much less expense, the saving of course varying with the local market price of the oil. In that ship, one thousand tons of oil can be carried in the double bottom, over and above that which could be stowed in the bunker spaces, and this one thousand tons would be sufficient to carry the vessel about five thousand miles.

The latest proposal for new subway lines is by President McAdoo of the Hudson and Manhattan Railroad Company, for the construction of a tunnel extending from Broadway and Thirty-third Street, one block from the new Pennsylvania terminal, southward along Broadway to Union Square, and thence under University Place and Church Street to the Hudson terminal station at Cortlandt Street. The great defect of this system is that it does not touch the Pennsylvania terminal. The Public Service Commission should see to it that any line built on the west side passes down Seventh Avenue, and actually taps this most important center.

The total quantity of Portland, natural and Puzzolan cements produced in the United States during 1909 was 64,196,386 barrels, valued at $51,232,979, an increase over 1908 of 21 per cent in quantity and 15 per cent in value. The Puzzolan cement is made by mixing blast-furnace slag with slaked lime, but its output decreased from 557,252 barrels in 1907 to 160,646 barrels in 1909. One of the newer developments in cement manufacture, says a late bulletin of the Geological Survey, is the production of white non-staining Portland cement. This supplies a growing demand for ornamental work and surface finish.

The report of the British Board of Trade on railway accidents in the United Kingdom during the year 1909, shows that only one passenger was killed in an accident to the train in which he was traveling, and that this was the first fatality for twenty preceding months. The number of passengers injured while traveling was 390, which is the lowest average for several years past. As 1,264,000,000 passengers were carried during 1909, the death record is certainly remarkably small. By accidents to passengers from other causes—falling between trains and platforms, etc.—directly traceable to personal carelessness and disobedience of orders, 82 persons were killed and 2,148 were injured.

AERONAUTICS.

At the Blériot school at Etampes, a two-seated Blériot monoplane has been tried with some success by Depireux.

At Limoges, France, on October 15th, M. Baillod, a monoplanist, in attempting a flight, steered his machine into a crowd, killing a girl and injuring several other persons.

The Laboratory Committee of the Aeronautical Society of Great Britain are now conducting a series of tests on the various component parts of aeroplanes. Experiments are in progress on the air resistance of bars, struts, stay wires, and the like.

The French Naval Minister has given orders that the cruiser "Foudre" is to be rebuilt as an auxiliary to marine aviation. A platform 125 feet in length is to be erected on the deck of the warship, to enable aeroplanes to start while at sea. Experiments will also be made to test the possibilities of landing on such a platform.

The achievements of the unfortunate Chavez in successfully crossing the Alps seems to have obscured an attempt made by Mars to cross the Rocky Mountains on October 3rd. He arose to a height of 7,000 feet, but his machine got out of control in the Elliston Pass, and fell. Although the machine was smashed, the aviator escaped.

On October 17th, Mr. John B. Moisant tried out for the first time his new Blériot racing monoplane. He made three excellent flights, each of about five minutes' duration, and the machine showed a speed of 53 miles an hour. It is fitted with a 50-horse-power Gnome motor, and has wings that are practically flat. An auxiliary torpedo-shaped gasoline tank is fitted below the body. On October 18th Mr. Moisant made a circuit of the large 5-kilometer (3.1-mile) course which will be used for the long-distance events. Afterward he flew from Belmont Park to Mineola and back, a distance of about 14 miles, which he covered in 17 minutes, despite a rather strong and gusty wind. On October 19th, while making another trial flight, Mr. Moisant attempted to reach forward and turn on the oil to the engine. In so doing he pushed the control column forward, and his machine dove to the ground. It was completely demolished, but luckily the daring aviator escaped without injury. Capt. Lovelace has built him a new Blériot, which he will use in place of his original racer.

The day before the opening of the meet at Belmont Park, Friday, October 21st, was a busy one at the aviation field. Three Wright machines were uncrated and assembled in tents, a fourth machine being expected to arrive Saturday. During the afternoon three different types of aeroplanes made flights simultaneously. These were Hoxey's Wright biplane, Harmon's Farman biplane (which was flown by Grahame-White) and J. Armstrong Drexel's Blériot monoplane. A Santos-Dumont Demoiselle was also flown by M. Garros, who expects to win a number of prizes with his tiny machine. Mr. John Frisbie flew from Mineola to Belmont Park at the close of the afternoon in his Curtiss-type biplane. Mr. James Radley, the Englishman who smashed his Blériot racer the week previously, has repaired his machine and made two trial flights of 2 and 5 minutes, respectively.

Altogether 37 machines are expected to participate in the aviation meet at Belmont Park. Hubert Latham's Antoinette monoplane was unloaded Friday afternoon, and was found to be in a badly damaged condition. The wings were broken in several places, and the body also was warped out of shape. Latham's larger 100-horse-power Antoinette is expected to arrive on Monday, October 24th. Should this machine not appear on time and should Mr. Latham be unable to repair his smaller monoplane, it is probable that he will fly one of the two Antoinette monoplanes of Mr. Harry Harkness. The latter gentleman is also entered in the meet.

The two most interesting machines at Belmont Park, neither of which has made its public appearance at the time of our going to press, are the new Wright racing biplane and the Curtiss single-surface or monoplane machine, both of which have been built especially for the purpose of winning the international cup race. The planes of the Wright machine are said to have "knife edges," and the resistance of the uprights, etc., is undoubtedly cut down to a minimum. There is no front rudder, and the single horizontal rudder at the rear is said to be very small. The machine will be flown by Orville Wright, the only man who has flown it. There are said to be new ideas in the rudders and propellers, and the motor, it is claimed, is of 60 horse-power. The Curtiss monoplane resembles very much his biplane machine, having a single-surface horizontal rudder in front. The positions of the aviator and of the motor are practically the same as in the biplane. It has only 150 square feet of supporting surface and a motor of 65 horse-power. It will be flown by Messrs. McCurdy and Ely ,and it is undoubtedly capable of making great speed.

SCIENCE.

Sir William Ramsay recently announced that radium now costs $2,100,000 an ounce, which price is slightly less than the value given by him about a year ago, as $2,500,000. A year ago there was said to be about one-quarter of a pound of radium in the world. As a matter of fact, the actual quantity is not now much greater. Radium banks have been established in Paris and London for the purpose of lending radium at a price. As much as $200 has been charged for the use of 100 milligrammes for a single day.

Prof. Herschel C. Parker, who returned recently from his unsuccessful attempt to climb Mount McKinley, spoke before the Explorers' Club, and made the statement that the summit of Mount McKinley was still unconquered. Prof. Parker traversed the entire route which Dr. Frederick A. Cook once claimed to have covered, and told the members of the Explorers' Club that he and his party contrived to stand on the very peak which Cook in his book labeled, "The top of the Continent," a peak relatively small, far away from the real summit.

Some of the smaller European towns of economical habits have been complaining because they are obliged to light their streets all night for the benefit of a few belated citizens, and have been trying to discover a method whereby the citizen who needs to have his pathway lighted in the small hours of the night shall pay the costs himself. On one of the streets of a small German town, such a system has actually been put into operation. The street is a little over half a mile long, and is provided with nine lamps. At each end of the street is a penny-in-the-slot machine, and whenever anyone wishes to light up the street, he has merely to drop in a ten-pfennig piece, which turns on the current for twelve minutes. This allows him ample time to walk the length of the street. The street is normally lighted until 10 o'clock. Thereafter the prepayment meter must be resorted to.

What a beautiful tone that bell has!" is often heard. There are few, however, who know how a bell receives its joyful or solemn tones. All bells after they are cast and finished must go through a process of tuning the same as any other musical instrument before they respond with a clear, true tone. Every bell sounds five notes, which must blend together in order to produce perfect harmony. The tuning of a bell is done by means of shaving thin bits from various parts of the metal. It is as easy for an expert bell tuner to put a bell in tune as it is for a piano tuner to adjust his instrument to perfect chords. At first thought it would seem that a bell would be ruined should the tuner shave off too much at the last tuning, or the fifth sound, but such is not the case. He would, however, be obliged to begin over, starting again with the first tone, and shaving the bell till it gave forth its harmonious sound at the fifth tone.

A new form of graphite has been brought to our attention which seems to be a novelty in its way. The graphite assumes the form of an intensely black, completely amorphous, and light flocculent mass. Indeed, so light are the particles, that it is possible to blow them on the floor by direct expulsion of the air from the mouth. Although the fluffy masses are quite without luster, they can be given a metallic sheen by friction with the hand. When placed in a mixture of gasoline and absolute alcohol, part of the graphite seems to have the remarkable property of being permanently suspended in the mixture, although the larger portion will be precipitated. The mixture of this amorphous, flocculent graphite with vaseline produces a lubricant which, for certain purposes, seems to excel the ordinary mixtures of graphite and oil. The new product is obtained by a special treatment of ordinary flake graphite. How remarkable is the volumetric change effected by the treatment may be gathered from the fact that the flocculent graphite occupies a space almost five hundred times greater in volume than the original flake graphite from which it was made.

A mammoth cave has been discovered in German East Africa in Mt. Nangoma, about an hour to the south of Nandembo. Though discovered in August, 1909, it was not explored till February, 1910, when the police officer, Weckauf, and a missionary named Ambros Mayer made a partial investigation of it. The entrance is 43 meters wide by 21 meters high, and the whole cave has a length of 329 meters. It is of pipe-like shape and has a funnel-shaped opening, caused by a cave-in. It is in a chalk mountain and caused by water erosion. The natives had long known of it, but concealed its existence from the whites. During the uprising of 1905-06 they used it for a hiding place for thousands, completely baffling the enemy. It contains a spring of fresh water, which gives it additional value as a refuge. Its entrance lies in the primeval forest. Evidence is strong that it has been the habitat of thousands of bats through untold years. It is hoped that funds will be forthcoming to provide for a thorough exploration, since this can hardly fail to yield prehistoric remains and antiquities of great interest and value.

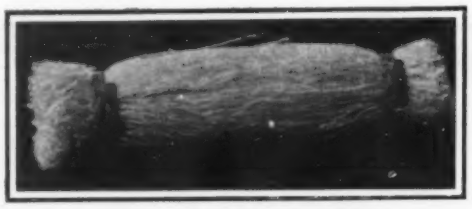
OUR WASTED SEAWEED RESOURCES

BY JOHN COWAN

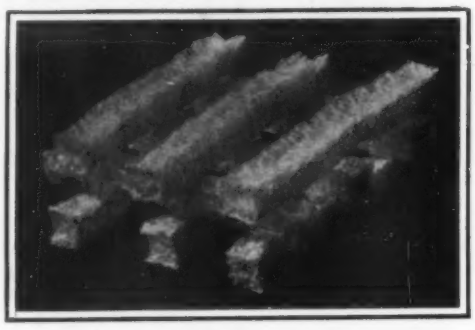
In these days, when so much is said about the conservation of natural resources and the utilization of products that are now neglected or wasted, it is strange that no account is taken of the marine forests and gardens that fringe our sea coasts. Yet since seaweeds (or algæ, a term including all plants that live in and derive their nutriment directly from the water, whether salt or fresh) are the only vegetation found over three-fourths of the superficial area of the earth, it must be obvious that their place in the economy of nature must be far from insignificant. Their most important function in water is the same as that performed by ordinary forms of vegetation on land—that of rendering animal life possible. They take the elements existing in water as impurities, and transform them into materials essential to animal life. They form the sole subsistence of fish and other marine creatures; while those that do not live entirely or at all upon algæ, must prey upon smaller or weaker animals that do.

Humboldt was the first to call attention to the work seaweeds perform as natural breakwaters, in preventing the rapid wearing away of coast lines. The whole west coast of the Americas is flanked by immense marine forests, the tallest plants in the world, that break the force of the tremendous tides of the Pacific. In a way, this use of marine vegetation is analogous to the office performed by land forests in preventing soil erosion.

It is evident, then, that seaweeds are not quite as useless as they are usually supposed to be. Along the coast of New England, British Isles, and western Europe, they are used as fertilizers. In many countries they are fed to swine and cattle. In Holland they have been employed in building dykes. Sometimes they are used for stuffing mattresses, cushions, and upholstered furniture; and experiments have been made for their use as a substitute for wood pulp in the manufacture of paper. The Japanese have displayed greater ingenuity than any other people in their utilization. Japan alone among nations prevents the exhaustion of its seaweed resources, and engages in "seaweed farming" in order to supply the demand for certain species. Portions of the coast have been entirely denuded of marine vegetation, and experimental planting on a small scale has been undertaken by the government, with encouraging results. In other sections seaweeds are extensively "planted," the variety employed being the red laver (*Porphyra laciniata*). This is manufactured into a great variety of food products, for domestic use and for exportation. Its cultivation is one of the most profitable branches of agriculture, the crop annually being worth $150 to $160 per acre. The area of suitable submerged lands is limited, and leased out by the local governments. From 2,250 to 2,500 acres are planted annually, nearly all in Tokyo Bay, and near Hiroshima, on the Inland Sea.



A bundle of slender kanten.



The bar or square kanten.

In a bulletin of the United States Bureau of Fisheries (1904, vol. xxiv, pp. 133 to 181) is given a description of the cultivation of the red laver in Japan, and its preparation for market or table use. In October and November, bundles of bamboo or brush are prepared, and taken to the grounds in boats at

(*Continued on page 349.*)

The Irish moss industry of Massachusetts. Raking up the product.

Seaweeds on sandy beach after a storm. The air vessels of the giant seaweed are conspicuous.

A filamentous variety of phyllospora.

Phyllospora Newviesil.

Microcladia Coulteri.

A common feather moss.

SOME INTERESTING SEAWEED SPECIMENS.

A PRISMATIC ALTITUDE AND AZIMUTH INSTRUMENT

BY JACQUES BOYER

A few years ago Claude and Driencourt invented a prismatic altitude and azimuth instrument, to which some improvements have lately been added by its constructor, Jobin. This instrument is employed, in connection with a chronometer, for observing the instant at which the apparent altitude of a star attains a fixed value, approximately equal to 60 deg. From such observations it is possible to determine the momentary position of the zenith and the celestial sphere, by reference to the positions of stars whose co-ordinates are known, or, conversely, to determine the position of an unknown star from the known position of the zenith. In the former case, the observations give the sidereal time and the latitude of the place; in the latter, they furnish data from which the right ascension and declination of the star can be computed. The instrument is designed especially for observations of equal altitudes of the same star, east and west of the meridian, from which it is possible to deduce (according to the known data) the time of meridian passage, the error of the clock, the geographical position of the local meridian, etc., and for observations of the equal altitudes of three accurately known stars, from which the latitude of the place, the time, or the error of the clock, and the precise value of the constant altitude employed can be calculated by methods which cannot be explained here. The construction and operation of the prismatic instrument are greatly simplified by making this constant altitude approximately equal to 60 deg.

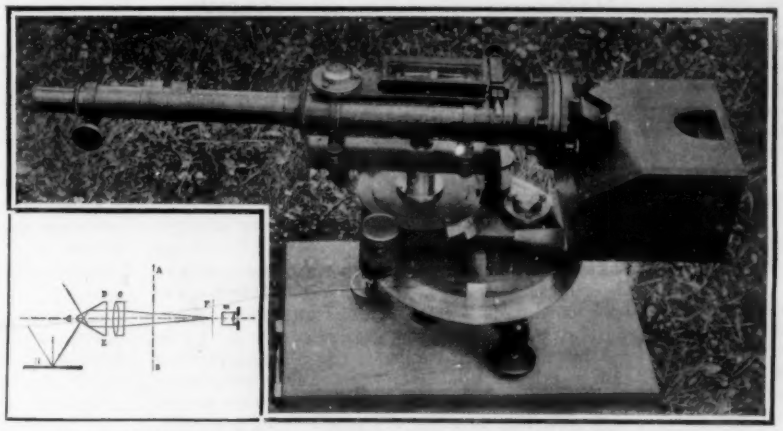


Fig. 1.—Prismatic altitude and azimuth instrument with diagram showing course of rays.

The principle of the apparatus is illustrated by the small diagram in Fig. 1. Immediately in front of the object glass *O* of a horizontal telescope an equilateral prism of glass is placed with its edges horizontal and perpendicular to the axis of the telescope. In front of and below the prism is a basin of mercury *H*, which serves as an artificial horizon. All of these parts are so mounted that they can turn, as one object, about the vertical axis *AB*. If the instrument is set so that the axis of the telescope and the star which is under observation are situated in the same vertical plane, represented by the plane of the diagram, the telescope will receive two distinct but mutually parallel beams of light from the star, at the instant when the apparent altitude of the star (i. e., its real altitude increased by atmospheric refraction) is exactly 60 deg. One of these beams enters the prism normally at the face *CD*, is totally reflected at the face *CE*, and emerges normally at the face *DE*. The other beam, reflected to the prism by the mercury horizon *H*, enters normally at the face *CE*, is totally reflected at *CD*, and emerges normally at *DE*, above the first beam.

Each of these beams forms an image of the star in the focal plane *F* of the objective. When the altitude of the star is increasing, and is slightly less than 60 deg., the two images are seen separately in the field of the telescope. The images approach each other as the altitude of the star increases, coalesce when the apparent altitude becomes exactly equal to 60 deg., and then separate and recede from each other as the altitude continues to increase. The same appearances are presented when the altitude is decreasing. In either case the coincidence of the two images occurs at the instant when the apparent altitude of the star is exactly 60 deg.

The details of construction of the instrument are shown in Fig. 2. The telescope *AA*, with its prism *C*, is capable of independent rotation about the vertical axis *a*, carrying with it the divided sector *M*. The bed plate of the leveling tripod *D*, which supports the parts mentioned above, is rigidly attached to one end of the bar *E*, which turns about the axis *r* and carries, at its other end, the mercury horizon *H*. The axis *K* is made vertical by the leveling screws *L*, and the angle through which it is turned is measured by means of the graduated circle *N*. The telescope is first turned about the secondary axis *a* until the zero of the small graduated sector *M* is opposite a fixed index. The bar *E*, which carries both the telescope and the mercury horizon, is next turned round the principal axis *K*, until the needle of the magnetic compass *B*, attached to the telescope, stands at zero. The axis of the telescope is now in the magnetic meridian. It could be brought into the astronomical meridian by turning it, in the proper direction, through an angle equal to the magnetic declination at the place of observation. It is found more convenient, however, to unclamp the graduated circle *N*, turn it,

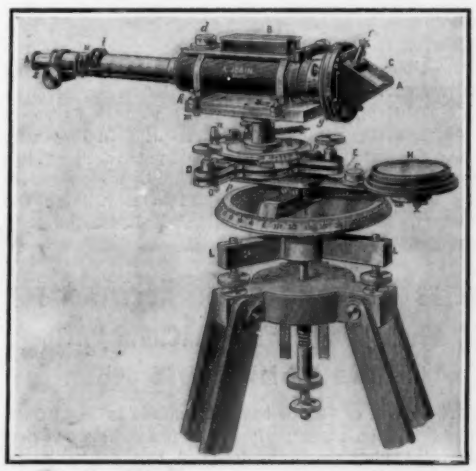


Fig. 2.—Prismatic altitude and azimuth instrument on its tripod.

independently of all other parts, until its index marks an angle (to the right or left of the zero) equal to the magnetic declination, and clamp it in this position. Then, in order to observe a star whose azimuth, at the instant when its altitude is 60 deg., is known, it is merely necessary to turn the bar *E*, which carries the telescope and the artificial horizon, round the principal axis *K* until the index marks this known azimuth on the graduated circle *N*. The azimuth of the star, however, changes in the course of an observation, so that the pointing of the telescope requires continual correction. In order to make this correction without disturbing the mercury horizon and thereby blurring the reflected image of the star, the telescope is provided with the independent axis *a* and the graduated arc *M*, which marks the correction applied to the approximate azimuth marked by the large circle *N*.

Other adjustments are made by means of parts which are indicated by letters in Fig. 2. The telescope is secured by two bands of metal, the ends of which are attached by the screws *K* to a plate attached rigidly to the axis *a*. When these screws are loosened the telescope can be turned on its axis or removed from the apparatus and replaced. To the tops of the straps is attached a plate which carries the compass *B* and the spherical level *d*. The prism *C* is mounted in an accurately centered collar, and its edges are made parallel to the horizon by means of the screw *b* and an opposing spring, acting upon a radial protuberance of this collar. The telescope is turned about the secondary axis *a* by hand, the clamp *n* being loosened. The fine adjustment is made with the tangent screw attached to the clamp. By these operations the two images of the star are brought into the vertical plane which contains the axis of the telescope, without disturbing the mercury horizon. The arc *M*, which moves with the telescope, bears a scale extending about 20 deg. on each side of the zero, the two halves of the scale being marked + and —. The axis of the telescope is made horizontal, without affecting the horizontality of the edges of the prism, by means of two leveling screws which are situated in a line parallel to the axis, while any deviation of the edges of the prism from horizontality can be corrected, without altering the direction of the telescope, by turning the third screw of the tripod *D*. The optical axis of the telescope is set perpendicular to the axis of rotation *a* by means of the adjusting screws *m*.

The tripod *D* is attached to its bed plate by the two spring clamps *p*. The reticle is composed of four wires, arranged in two pairs at right angles to each other and forming a square 5 seconds in width. The reticle is illuminated by the rays of a lamp which enter the telescope through the lateral aperture *t*. A small incandescent electric lamp, operated by a dry battery which is placed on the compass *B* and secured by a rubber band, is supplied with the instrument, but any ordinary lamp may be employed.

The posterior face of the prism is set perpendicular to the optical axis of the telescope by means of a collimating eye piece and the screws *h*.

The artificial horizon *H* is a shallow copper basin filled with mercury, which becomes thickened by amalgamation with the copper. The base of the basin is conical and accurately fits a conical bearing attached rigidly to the bar *E*. The axis of the bearing is set parallel to the principal axis *K*, once for all, by means of the adjusting screws *s*. If the bar *E* has been accurately leveled the rim of the mercury basin will then be level in every azimuthal position of the basin in its bearing. Sufficient mercury is poured into the basin to fill it to the brim, without forming a meniscus, any excess of mercury flowing away through a gutter which surrounds the basin. A glass rod is passed over the surface of the mercury to remove impurities. The mercury horizon is sheltered from the wind, in outdoor observations, by a black wooden cover, provided with the apertures required for the passage of the incident and reflected rays. Disturbance of the surface of the mercury by currents of air entering these apertures is prevented by a number of partitions inside the cover.

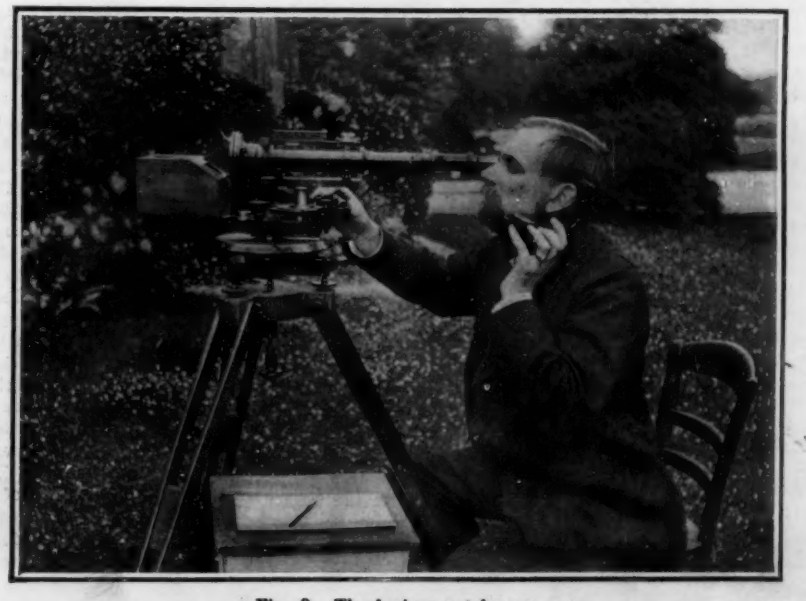


Fig. 3.—The instrument in use.

Instruments of this type, pro-

vided with telescopes of 2½ inches aperture and a power of 150 diameters, have been employed with success in the determination of the difference in longitude of Paris and Brest, the geodetic survey of Ecuador, the establishment of the boundary between the Congo and Kamerun, the explorations of Moll and Cottes, and other recent geodetic and astronomical measurements. Jobin also constructs a smaller and simplified model, with a telescope of about 1-inch aperture and a power of 30 diameters, for use in observations in which the utmost precision is not required.

The Psychology of Aviation.

BY JOHN B. HUBER, A.M., M.D.

The airman is peculiarly interesting with regard to the three factors essential in human personality—heredity, will, and environment; the factors fundamental to the consciousness with which psychology concerns itself.

Every morning we read of a fresh feat to the extremest limit—and beyond—of human endurance. Paulhan was benumbed and almost paralyzed, both in psychism and in body, at the end of the first stage of his flight from London to Manchester. Brookins, in a continuous flight of eighty-eight miles, was under excessive strain, "nearly paralyzed in the arms," and had to "use his knees in operating his machine." Morane, after ascending several thousand feet, was so chilled, and suffered such pain, that he could with difficulty control his machine, or descend and make a landing. The coming down from a height above 8,000 feet occupied but a few minutes; but to Morane it seemed an eternity.

Wynmalen, a newcomer in aviation (every morning brings its hero), has established a new record (new at this writing, but in how few days will it be exceeded) of an ascent of 9,121 feet. This young Hollander—of but twenty-one years—rose until his motor failed him; and then made a hazardous descent. He suffered intensely. Arising from the ground, his spiral course attained 8,200 feet. Though the air was bitter cold, though his ears and fingers were numbed, and an icy gale slashed his face (checking, and at times driving back his machine), he nevertheless continued to ascend until his motor stopped. Despite superhuman will, no greater height could therefore be achieved; and Wynmalen had to plane down to the earth. This was done in thirteen minutes; but the graduated descent required a battle with a wind that threatened to dash the biplane and its master to the ground. It was found that the carbureter had been frozen at the high altitude, thus crippling the power of the machine.

Most of those who have made records of distance traversed and of the time of flying have confessed to the almost intolerable strain of the ordeal; yet in every case the feat performed is but a prelude to another and a greater.

With regard to the third factor essential in human development, we come upon an element in which there has heretofore been practically no human experience—that is, the atmosphere environing the airman who operates in a heavier-than-air machine. Ignorance here has recently cost more lives than one likes to recall. The Wrights and their congeners have taught men how to fly; but the medium in which they must fly has not been, and cannot be charted, though study of aerial phenomena will, it is hoped, help the future aviator. Such investigations have indeed been begun; as for example: Many years ago Prof. A. L. Rotch, using kites carrying measuring instruments, made tests of air velocities at different heights from his observatory at Blue Hill, near Boston. By measuring sailing clouds trigonometrically from a base line to ascertain their velocity at heights above six miles, it was found that these velocities increased progressively with the ascent into the air; also that the velocity of the upper winds in winter is more than double that in summer, as high indeed as 223 miles an hour. Prof. Rotch concluded that the currents in the various levels of the atmosphere are of vastly more importance to the aeronaut than are the ocean currents or surface winds to the sailor; yet at present the aeronaut knows almost nothing about the former. Water is indeed security itself by comparison with the treacherous air, her vacuu and her insidious gusts. At high altitudes no airship (so it would now seem) could live; the airman, unless he can read the signs in the movements and gathering of the clouds, can never be sure how long the winds are going to be kind to him.

For the aviator there is indeed no moment's rest or freedom from anxiety after leaving good Mother Earth, until he returns to the security she assures. Airmanship differs from locomotion on the ground in that it requires three-dimensional steering. All other vehicles move in a single plane; and their occupants are not in danger while they keep in a path, and do not collide with implanted obstructions or other vehicles. The bicycle is a two-dimensional conveyance, in that it must be both propelled and balanced; but once in motion there is no difficulty. On the other hand, "the airman can make mistakes all around a sphere," any one of which is likely to prove instantly fatal. Moreover, he must be constantly on the watch, his nerves tense, his senses most acute, lest disaster befall him. He has to listen to every sound (or for a cessation of sound) from a most complicated and delicate engine; he must manipulate one rudder for up and down, another for right and left, and two more at the ends of the wings. All his faculties must be most sympathetically co-ordinated; and this co-ordination must be in accord with a veritable new sense—the flying sense. Indeed, the power to travel by air is a wholly new capacity; by which will conceivably be revolutionized many of the now fundamental conditions of human life—not only the material and physical, but also every shade of psychic existence. "More than ever will man grasp for and toward the unknown, more than ever will he be tempted and enthralled in the endeavor to fathom the abysses that stretch above and below and all about him."

Another peculiarity in aviation is that the neophyte cannot, except by the use of the glider, begin by degrees and gradually accrue in skill; his very first flight must be made at great speed and well above the ground, if it is to be made at all. The beginner must at once attain, and maintain, so long as he remains in the air, a complex co-ordination of mind and muscle such as has practically never before obtained in human experience. It is therefore no end of wonder that so many are now able to fly—before they have learned to fly. At present, of course, this number is vastly in the minority among us; the rest of us are perfectly content to look on, keeping our feet well planted the while. Yet it is extraordinary how the flying minority is daily growing. There is now organized an Aero Reserve, which has already a membership of 3,200, and a home or club house in New York city. This "United States Aeronautical Reserve" is made up of aeroplane inventors, designers and builders of aeroplanes and their equipment, army and navy officials from the President down, men prominent in the militia of the various States, financiers, statesmen, newspaper men, sportsmen—almost every phase of our national life being represented. Though we cannot all fly now, declared an enthusiast, "everybody will be able to do so in time; and that means such a revolution in life as no other invention, or all of them put together, has brought about. A winged race would be more superior to the one we know than civilized man is to the savage, and its horizon would be almost infinitely extended."

RULES GOVERNING THE COMPETITION FOR THE $15,000 FLYING MACHINE PRIZE OFFERED BY MR. EDWIN GOULD.

1. A prize of $15,000 has been offered by Mr. Edwin Gould for the most perfect and practicable heavier-than-air flying machine, designed and demonstrated in this country, and equipped with two or more complete power plants (separate motors and propellers), so connected that any power plant may be operated independently, or that they may be used together.

CONDITIONS OF ENTRY.

2. Competitors for the prize must file with the Contest Committee complete drawings and specifications of their machines, in which the arrangement of the engines and propellers is clearly shown, with the mechanism for throwing into or out of gear one or all of the engines and propellers. Such entry should be addressed to the Contest Committee of the GOULD-SCIENTIFIC AMERICAN Prize, 361 Broadway, New York city. Each contestant, in formally entering his machine, must specify its type (monoplane, biplane, helicopter, etc.), give its principal dimensions, the number and sizes of its motors and propellers, its horsepower, fuel-carrying capacity, and the nature of its steering and controlling devices.

3. Entries must be received at the office of the SCIENTIFIC AMERICAN on or before June 1st, 1911. Contests will take place July 4th, 1911, and following days. At least two machines must be entered in the contest or the prize will not be awarded.

CONTEST COMMITTEE.

4. The committee will consist of a representative of the SCIENTIFIC AMERICAN, a representative of the Aero Club of America, and the representative of some technical institute. This committee shall pass upon the practicability and efficiency of all the machines entered in competition, and they shall also act as judges in determining which machine has made the best flights and complied with the tests upon which the winning of the prize is conditional. The decision of this committee shall be final.

CONDITIONS OF THE TEST.

5. Before making a flight each contestant or his agent must prove to the satisfaction of the Contest Committee that he is able to drive each engine and propeller independently of the other or others, and that he is able to couple up all engines and propellers and drive them in unison. No machine will be allowed to compete unless it can fulfill these requirements to the satisfaction of the Contest Committee. The prize shall not be awarded unless the competitor can demonstrate that he is able to drive his machine in a continuous flight, over a designated course; and for a period of at least one hour he must run with one of his power plants disconnected; also he must drive his engines during said flight alternately and together. Recording tachometers attached to the motors can probably be used to prove such performance.

In the judging of the performances of the various machines, the questions of stability, ease of control, and safety will also be taken into consideration by the judges. The machine best fulfilling these conditions shall be awarded the prize.

6. All heavier-than-air machines of any type whatever—aeroplanes, helicopters, ornithopters, etc.—shall be entitled to compete for the prize, but all machines carrying a balloon or gas-containing envelope for purposes of support are excluded from the competition.

7. The flights will be made under reasonable conditions of weather. The judges will, at their discretion, order the flights to begin at any time they may see fit, provided they consider the weather conditions sufficiently favorable.

8. No entry fee will be charged, but the contestant must pay for the transportation of his machine to and from the field of trial.

9. The place of holding the trial shall be determined by the Contest Committee, and the location of such place of trial shall be announced on or about June 1st, 1911.

The Current Supplement.

The current SUPPLEMENT, No. 1817, opens with an excellent article on the passenger airship "Ville de Lucerne," which has been making some very remarkable flights in Switzerland.—One of the most noticeable features of an animal is its ability to produce heat. How this heat is produced Mr. David Fraser Harris considers from a chemical standpoint.—The second installment of Mr. Grover Cleveland Loening's "Practice and Theory of Aviation" is presented.—Sir John Gavey reviews the recent developments in telegraphy and telephony.—Prof. T. J. J. See contributes an article on some recent developments in cosmical evolution, in which he outlines some theories of his own.—An article on the isolation of radium is also published.—In 1903 an American firm discovered a method of producing synthetic camphor at a price which enables it to compete on favorable terms with the natural product. Naturally, this lends a peculiar interest to G. Blanc's article on "Synthetic Camphor and Its Industrial Future."—Prof. E. Gehrcke writes on electrical radiations in nature, in which he shows that the radiations which it took us many years to discover in the laboratory have manifested themselves to the human eye for ages.—The increased attention now directed toward trackless electric roads is probably due to the unusual spread of electric current distribution from long-distance power stations. Be that as it may, the subject is one of considerable electrical importance. Mr. A. Heller considers it in the most thorough manner.—Past theories and future research relating to solutions are considered by Dr. Louis Kahlenberg.

The Measurement of Smoke in the Air.

In the battle against the plague of smoke, which began only in recent years, and especially in the large cities, it was felt that an apparatus for the measurement of the quality and quantity of smoke would be a most serviceable aid. Such an apparatus has just been devised, and consists of a short brass tube to one end of which a light disk of celluloid has been attached. This disk is divided into four segments, which are colored with different shades of gray and correspond to the graduation from perfectly clear air, free from smoke, to air of thorough darkness. Every segment of the disk has a hole in its center, so that the observer looking through the tube can see and compare at the same time the disk and a part of the sky lying behind the latter.

The little apparatus is used in the following simple way: the instrument is pointed, for instance, at the mouth of the chimney of a factory whose development of smoke the observer is seeking to ascertain. Then the disk before the tube is turned until the color of a segment agrees with the color of that part of the background seen through the hole. It can then be stated to which of those four degrees the chimney's development of smoke belongs. This procedure will also be of especial value when measures are taken to diminish the development of smoke, as it will indicate very closely the degree of their efficacy; and certainly when applied it will have to give particular attention to other conditions of the atmosphere also, for smoke is not the only source of the impurity and murkiness to which the air is exposed.

MAGIC FOR AMATEURS—XV

AUTOMATIC APPARATUS FOR CARD TRICKS

BY W. H. RADCLIFFE

NO. 34. A PHANTOM CARD FRAME.

One of the most ingenious mechanical devices for use in card tricks is the phantom card frame shown in Fig. 53, where *A* represents the front, *B* an interior back view, and *C* an exterior end view. It is automatic in action, yet easily made from articles common in every household.

A picture frame *n* about eleven by fourteen inches in size, fitted with glass, a set of shade brackets *oe*, a spring shade roller *r*, and a dark-colored (preferably black or dark green) shade, are the chief requisites.

The glass should be securely fastened in the frame with tin tacks or matting tacks. The shade bracket used for the spring end of the roller is screwed to the inside of the frame near the top at *o*, so that its slot opens upward. The end of the roller belonging in this bracket is then inserted, and the roller is marked to be cut so that when the other end piece and the bracket are fixed in place, the latter near the top of the frame at *e* in line with the other bracket and the former on the cut end of *r*, the roller works freely.

A shallow wooden case *m* for the back of the frame must next be made; this should be closed except on the side toward the front, and be deep enough to enclose the spring roller equipment. It should be held to the frame proper by hooks *hh* at the sides. Narrow wooden strips *i*, etc., nailed to the back of the frame serve well as guides within which the case can be held securely by the side hooks. The inner back side of the case *m* must be covered with some of the dark-colored shade material. Mucilage or paste should be used to make it adhere to the wood.

The shade material to be used on the roller must now be cut and fastened in place. It should be wide enough to project well beyond the inner side edges of the mat *d* pasted on the inner surface of the glass to screen the roller *r*, etc., from the front. In length it should be about three inches longer than the inside height of the frame. Tack one end of the shade to the roller, using ordinary shade tacks for the purpose. Turn over the other end of the shade and stitch it, leaving a hem in which to insert a stick. The length of the stick should be equal to the width of the shade, and it should be thick enough not to be drawn between the roller and the top of the frame, else the shade will be carried around and entirely unrolled. A narrow wooden strip *x* nailed to the inner top of the frame against the glass will aid in stopping the stick at the proper place.

The usual latch or pawl on the spring end of the roller should now be pried off, so that the shade will be freely drawn up on the roller when released. The next step is to provide the catch *s* to hold down the shade when it is desired to have it act as a screen. The catch should consist of a fairly heavy wire bent as shown and twisted loosely around a staple *p*, on which it can work as a fulcrum, the staple being driven into the frame across a groove *f* cut into the lower back part of the frame. When the lower curved portion of the wire *s* is pushed backward, the upper curved portion will move forward, and *vice versa*. If then the shade be pulled down and the stick in its hem forced under the upper curved end of the wire, the shade will be held down until the lower part of the wire is pushed forward. A small piece of tin bent tightly over that portion of the covered stick where the wire *s* engages with it from behind, makes the action of the catch more sensitive and more sure.

The frame is now ready for use. Three cards, duplicates of which must later be forced on one of the spectators either by using a pack of three suits as described in Trick No. 16, or by thumb manipulation of the lower cards in the pack as described in Trick No. 3, are fastened by paste, glue, or thumb-tacks to the dark shade-covered back of the case *m*, so that they can be seen readily in the front view *A*, through the glass *w* of the frame when *m* is hooked in place. The shade is next drawn down and secured by the catch *s*, and after the two parts of the frame are fastened together, the device is hung against the wall by a short cord fastened to the hooks *u* and *v*, care being taken not to allow anything to touch the wire *s* so as to cause it to release its hold on the shade. By using a short cord the top part of the frame is held against the wall, and its lower part slants outward so that the wire *s* does not come in contact with the wall.

After the three forced cards have been drawn and carefully noted by the spectators, they are returned to the pack. The performer calls attention to the empty picture frame hanging on the wall and, taking the pack, asks the audience to watch their chosen cards pass from the pack, fly through the frame, and affix themselves within it. He then throws the pack against the lower part of the frame, so as to cause it to swing backward. The lower curved portion of the wire *s* is thus forced against the wall which, in turn, presses this part of the wire outward and causes its upper end to move back, so as to release the shade and allow it to fly upward.

The shade having the same color as its background, and the movement being rapid, leaves the spectators in doubt as to what has taken place, the effect being as though the chosen cards had actually passed out of the pack and placed themselves within the frame, under the direct gaze of the audience.

Although it is not wise to pass the entire frame to the audience for inspection, it is advisable to show and hand out as much of it as possible. Therefore, take down the frame from the wall and, laying it on its back upon the table, unfasten the side hooks *hh* and hold up the front part, keeping its pretty side toward the audience.

Tap the glass lightly to indicate what it is, and hold the frame in front of the face to show that it is transparent. Tell the audience this part of the frame is really so simple that it is a shame to waste time describing it, but that the back part is much more complicated. Then place the frame front upward upon the table, and take up the case *m*. As there is no objection to having the audience inspect this part, and as

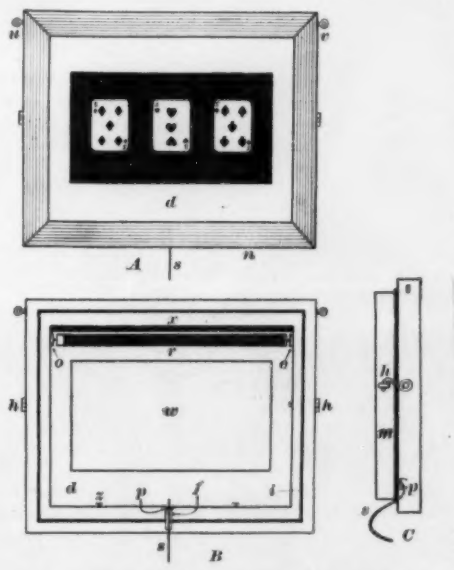


Fig. 53.—A DISCARDED PICTURE FRAME, WINDOW SHADE AND ROLLER, WITH AMATEUR CARPENTER WORK MAKE A HIT WITH CARDS ON ANY AUDIENCE. FRONT, REAR, AND SIDE VIEWS OF DEVICE SHOWN HERE.

an examination of it coupled with the remarks just made lead the spectators to believe they have seen all, none but a crusty old fakir would refuse to extend this courtesy to his audience.

The Fifth International Balloon Race for the Bennett Trophy.

Ten balloons left St. Louis late in the afternoon of Monday, October 17th, in a record-breaking race for the Bennett trophy. Four countries were represented in the race, France and Switzerland having two balloons each, while Germany and America had complete teams of three each, as allowed by the rules. All the balloons made a good start between 4:40 and 5:54 P. M., and soon disappeared from view following a northerly course.

The first balloon to descend was the American entrant "Million Population," Louis Von Phul, pilot, and Mr. O'Reilly, aide. This aerostat descended six miles north of Racine, Wis., at 7:25 A. M., Tuesday, after covering about 320 miles air line distance. Its highest altitude—4,500 feet—was attained near Vernon, Ill., during the night. The pilot claimed his balloon had small holes eaten in it by grasshoppers as it lay exposed on the ground the night before the race, and that owing to its leaky condition, as well as lack of ballast, it could not stay up longer.

The first balloon to start from St. Louis, and the second to descend, was the "Condor" of M. Jaques Faure, which alighted four miles north of Two Rivers, Wis., after sailing over Lake Michigan from Sheboygan. The "Condor" passed Racine at 6:30 A. M. and Two Rivers at noon. A note dropped at the latter place showed that the balloon had been traveling close to the surface of the lake. The landing was made late Tuesday afternoon after 21 hours in the air. M. Faure and his aide, M. Schmolck, said that while 9,000 feet above Lake Michigan Tuesday morning they struck a cool spot that caused so sudden a contraction of the gas that they dropped over 6,000 feet in 10 minutes. They threw out all their ballast and finally had to drop their drag rope, after which they kept at a height of only 50 feet until they finally landed. The distance covered by the "Condor" was about 420 miles.

The third balloon to come to earth was the "St. Louis IV." of Mr. H. E. Honeywell, which landed near Hillman, Montgomery County, Mich., late Tuesday. The aeronauts were nearly out of ballast and so were unable to cross Lake Huron after having crossed Lake Michigan successfully. The air line distance traversed was about 570 miles.

Alfred Le\'anc's balloon "Isle de France," the fifth to descend, traveled a much greater distance than any of the others yet mentioned. M. Leblanc, being an aviator of note as well as a balloonist, was obliged to descend before he got too far away, in order to appear at the Belmont Park aviation meet on Saturday. Accordingly he landed in a forest three miles north of Pogamasing, Ont., after a trip of 34 hours and 36 minutes duration. The distance he covered was about 710 miles.

The German balloon "Harburg II." (Lieut. Leopold Vogt, pilot, and William F. Assman, aide) was the fourth to descend, which it did at 11 o'clock Tuesday night, landing with terrific force upon the surface of Lake Nipissing, Ont., after a drop of 18,000 feet. The distance they covered was 850 miles. Theirs was one of the most exciting aerial journeys on record. They passed over Milwaukee, Wis., at 6:35 A. M. Tuesday after an uneventful night spent at an altitude of 6,000 feet. After crossing Lake Michigan, Grand Haven, Mich., was reached at 9:55 A. M., and Lake Huron came within view at 1:10 P. M. By 3 P. M. they completed the crossing of Lake Huron at Alpena, and three hours later they were above Canada. At 9 P. M. Lieut. Vogt attempted to land, as the ballast was getting low, but he found himself above Georgian Bay. After crossing the bay and attempting to land by the drag rope, Lieut. Vogt again ascended to a great elevation, and while at a height of 18,000 feet he pulled the valve cord, causing the balloon to make a terrifying drop. The wind caught it in its swift descent and carried it over the water. The impact was so hard that both aeronauts were knocked unconscious momentarily. Lieut. Vogt swam to a nearby island and towed the balloon and his aide, landing both safely. Mr. Assman tied the balloon to a tree, despite a broken arm and other severe injuries. The next morning some Indian hunters rescued both men.

The sixth balloon to descend was the "Helvetia" of Col. Theodor Schaeck, which landed north of Lake Temiscaming, in the province of Quebec, Can., on Wednesday morning. The distance traversed was about 800 miles.

The "Germania," the only aluminium-coated balloon in the race, landed Wednesday morning at Coocoocache, 179 miles north of Quebec. Capt. Von Abercron was the pilot and Herr A. Blankertz aide of this balloon. The time in the air was 36 hours, and the distance covered over 1,200 miles, so that in all probability the world's distance record of Count de la Vaulx has been beaten.

Two other balloons had not been heard from at the time of our going to press, and the Canadian authorities have been asked to institute a search in the forests of Canada. The missing balloons are the "America II.," manned by Messrs. Hawley and Post, and the "Düsseldorf II." of Lieut. Hans Gericke, with S. F. Perkins as aide.

The eighth balloon to be heard from was the "Azurea" of Switzerland, piloted by Emile Messner and Leon Givandau, which landed in the wilderness 32 miles northeast of Biscotasing, in the Algoma district of Canada. The balloonists spent three days and a night working their way through the woods and swimming across a lake. The temperature was 11 deg. F. during the night. The distance covered by this balloon probably equals that covered by the "Germania."

Phosphorescent Enamel.—Mix 15 parts of luminous color, 10 parts of fluor spar or cryolite powder and 3 parts borate of calcium, rub the whole down with water, apply it to porcelain, glass, etc., and burn it in the ordinary manner.

STORY OF THE WELLMAN OCEAN AIR TRIP

VIVID ACCOUNT OF THE TRIP BY MR. VANIMAN.

After months of preparation and weeks of patient waiting, while the public grew daily more clamorous and censorious, the Wellman expedition was finally launched on the morning of October 15th. Scarcely a breath of air was stirring, and sea and land were covered with a heavy fog, making the conditions for launching the airship almost ideal. With the break of day the decision to make a start was announced to the local fire and police headquarters, and with the assistance of these departments the balloon was taken out of its hangar, the lifeboat was made fast to the car, and the long equilibrator was attached and hauled to proper position. At 8 o'clock the airship drifted out to sea, followed by a tug, which endeavored to keep in communication with it as long as possible.

The experiences of the members of the expedition on the voyage thus begun have been fully recounted in the newspapers, but the flight as viewed by an experienced engineer has been told us by Mr. Vaniman, who designed the craft, and his story differs in important technical particulars from those that have so far been published.

Starting with a southwesterly breeze and using the after engine, the ship made good progress in a northeasterly direction. Everything had been in a state of readiness weeks before the start, and thorough tests had been made in the hangar of every vital part of the construction. (The details of the car were published in our issue of October 1st.) It seems as though nothing could have been overlooked. But there was one vital element that had escaped the keen observation of Engineer Vaniman. The after engine, as was previously explained, was arranged to drive its propellers through the medium of bevel gearing, so that the propeller shafts, which were disposed at right angles to the driving shaft of the engine, could be swung bodily about in a complete circle, thus making it possible to employ the thrust of the propellers in any direction desired. The fatal mistake consisted in not furnishing this engine with a flywheel. For four hours it was operated steadily, not missing more than two explosions in this entire period; but the absence of the flywheel produced a pounding action, and the keys of the bevel gearing eventually worked loose, rendering the engine useless. How serious this loss would be was not appreciated until the next day, as will presently be explained.

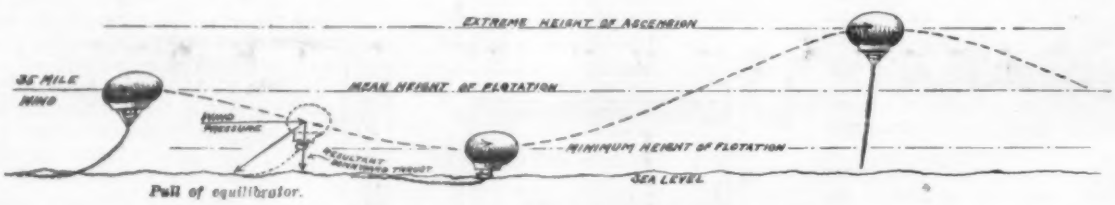
During Saturday evening the airship was in danger of being blown onto the shore of Long Island by a southerly shift of the wind, and it was necessary to use the engine to keep her headed offshore. The fog still persisted, and there was constant fear that the two-ton equilibrator trailing in the water would strike some vessel, which would result in immediate disaster to the airship, for it would draw it down into the sea; furthermore, it might do a great deal of damage to the vessel encountered. The moon was full, but owing to the fog it was impossible to see anything ahead. Two lookouts were stationed to endeavor to prevent collision with any ship. Suddenly the sound of a fog horn was heard, and almost immediately the mast of a schooner loomed up dead ahead. But the airship responded beautifully to the tiller, and swung to one side, just clearing the vessel by a narrow margin. This experience, as recounted by the captain of the vessel, was most thrilling He had no knowledge of any contemplated voyage by airship across the ocean, and he was greatly frightened when the air craft suddenly loomed up out of the fog with the sparks streaming from its red-hot exhaust pipes and making a terrific racket with its unmuffled engine. The lashing equilibrator with one tank empty, due to leakage of gasoline, was being pounded by the water, giving a weird, hollow sound that added much to the terror of his crew. This was the only approach to a collision experienced.

Mr. Vaniman had had no idea that his engine was throwing sparks until this was shown at night. The exhaust pipe terminated directly back of the propellers, so that the sparks were carried off in the wake of the propellers, and there was little likelihood of their lodging in the fabric of the balloon. Furthermore, the airship had been traveling through fog ever since it started, and it was dripping wet through-

By courtesy of the New York Times.

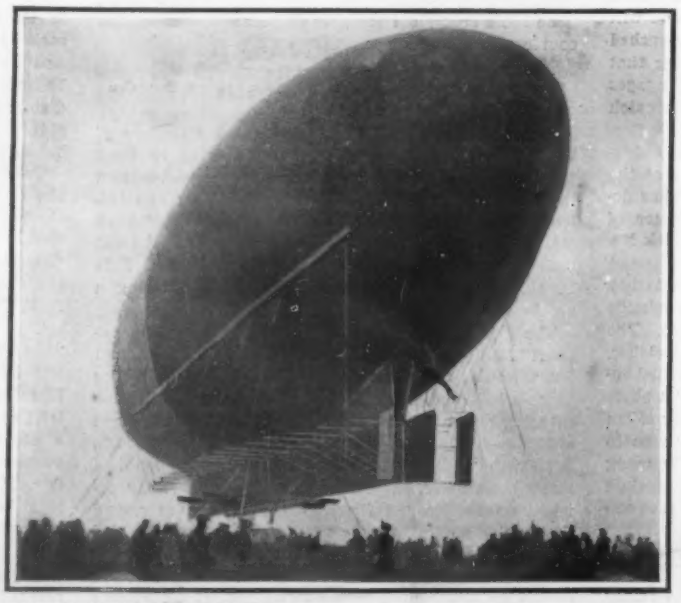
Chart showing course of the airship.

out, so that there was practically no danger of fire. Sunday morning the fog still continued, and the wind veering to the west began to freshen, so that it was unnecessary to use the engine; but with the freshening of the wind a new danger arose. The airship had started out of Atlantic City with an extra supply of gasoline aboard, so that it hung very low over the water, all but six tanks of the twenty-nine in the equilibrator being submerged. With the freshening wind it was found necessary to throw over surplus gasoline, so as to lighten the airship. Had this gasoline been left behind to start with, the airship would have made better progress and would have been much farther on its way when the wind freshened; but the extra gasoline was taken on in the expectation that the fog would eventually lift, and under the heat of the sun the gas in the balloon would expand and lift the airship to its normal position. However, the sun remained hidden by clouds of fog. Sunday afternoon and evening the wind had reached a velocity of thirty-five miles per hour. The night grew very cold, shrinking the balloon and making it necessary to throw out more gasoline. Then a peculiar motion began to manifest itself. It will be recalled that the purpose of the equilibrator was to hold the airship at a practically constant level above the sea; in other words, the airship and the sea were to divide between them the burden of supporting the two-ton equilibrator. If the ship showed a tendency to rise, it would be weighted by having to lift a greater weight off the sea, and if it showed a tendency to descend, it would be lightened by letting more of the equilibrator be floated on the sea, with the result that the airship would be held at a practically uniform elevation above the water. However, when the wind freshened, the drag of the equilibrator began to set up a surging motion. It would pull the airship down slowly but surely until it almost touched the water, then the airship would rebound with gathering momentum, pulling the equilibrator out of the water tank by tank and block by block until it was lifted clear of the surface. The equilibrator would now swing forward like a pendulum, and as its weight gradually overcame the buoyancy of the balloon, it would strike the water, and the dragging action would again commence. In this way the airship kept constantly oscillating up and down, the period of the oscillations being about ten minutes. On one occasion the big balloon swung so near the water that the waves struck the lifeboat cradled below it. There seemed to be no way of preventing this. It was then that Mr. Vaniman realized the loss of his after motor; for had he been able to use these propellers to lift the airship when it showed a tendency to be dragged down, the oscillation could have been largely, if not entirely, prevented, and the vessel could have been kept at a constant normal height. The thrust of the propellers which might thus have been used was 800 pounds, and this would have been more than sufficient to correct the surging movement. Had the airship been further lightened it might even have been possible to lift the equilibrator free from the water, when there would have been no drag to contend with, and it would have been possible to steer the craft into the wind. As it was, the airship was helpless. It was drifting broadside to the wind. As long as the oscillatory motion kept up it would have been perilous to have pointed the vessel into the wind, for then it would have been tipped up and down on its beam ends. As long as the wind held from the right direction, it mattered little whether the engine was used or not; but the oscillatory motion was nerve racking, and not at all calculated to inspire the crew with any feeling of security. The pounding of the waves on the equilibrator, about which so much has been published, amounted to practically nothing according to Mr. Vaniman. The jars were not at all serious; but considering the experiences they had gone through, the crew was ready to exaggerate the slightest unusual shock, and the harmless pounding appeared to assume dangerous proportions.



Explanation of the periodic surgings during the gale.

Sunday was a night of grave apprehension. It was found necessary to throw over a large quantity or precious gasoline as well as the damaged engine in an effort to prevent the airship from being dragged down into the water. Monday morning, however, the sun rose clear and hot, and beat upon the huge gas bag. There was no wind to counteract the heating effect, because the vessel was drifting with the wind, and the gas heated rapidly and expanded so quickly that it lifted the balloon despite its heavy equilibrator to an altitude of 3,000 feet before it could be checked. The rise was so rapid as to make the crew dizzy and affect their ear drums. Mr. Vaniman operated the valves to let out the hydrogen, in the meantime watching the statoscope for the first warning of the beginning of descent. Despite the utmost precaution and the most careful handling of the valves, the descent took place quite as suddenly as the ascent. As the balloon fell it gathered momentum and also lost buoyancy, due to the contraction of the gas bag in the increasing density of the



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The "America" just after it was taken out of the hangar.

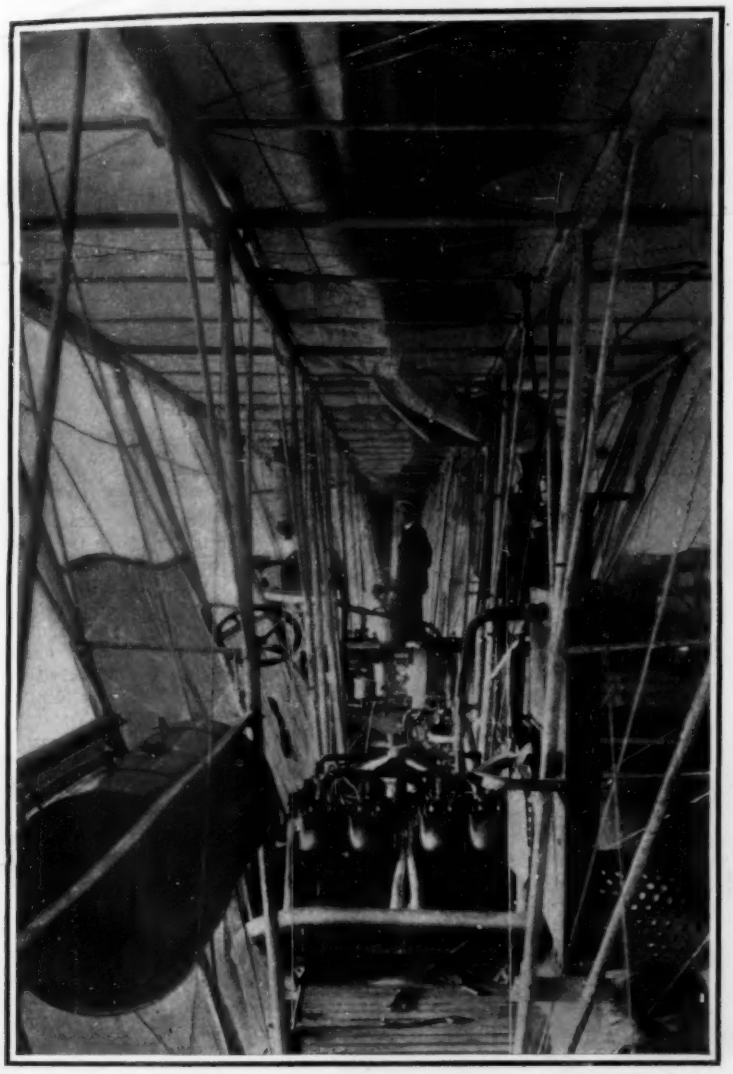
STORY OF THE WELLMAN OCEAN AIR TRIP.

lower strata of air. This contraction of the gas bag produced a constant downward accelerating force, greatly increasing the speed of the descent. However, there was nothing to fear, because of the great equilibrator suspended below them. This served as a cushion to ease their fall. It entered the water at enormous speed, and sank until the last can was submerged before the airship, relieved of its weight, could recover and rise again. This one experience was sufficient to show the value of the equilibrator. Had there been no such device provided, the airship must inevitably have been carried into the sea at the end of its downward plunge, striking the water at such velocity as to crush out the lives of all on board. Had the airship started out without an equilibrator, it would frequently have been necessary to throw over ballast to prevent such descents, and it would as frequently have been necessary to open the gas valves to prevent ascension to dangerously high altitudes. Mr. Vaniman states that without the equilibrator the airship could not have kept afloat a single day.

Monday the sailing was good; but the wind had veered around to such a direction as to drive the airship southward. It was then planned to head for the Azores Islands, and later in the day a further shift of the wind made it necessary to head toward Bermuda. The oscillatory motion continued under the action of the wind, and it was necessary to lighten the balloon of still more gasoline.

When, early in the morning on Tuesday, the lights of the steamship "Trent" were made out on the horizon, it was decided that further continuation of the voyage would be foolish. There remained but little gasoline in the main tank, and much of the gas

(*Concluded on page 351.*)



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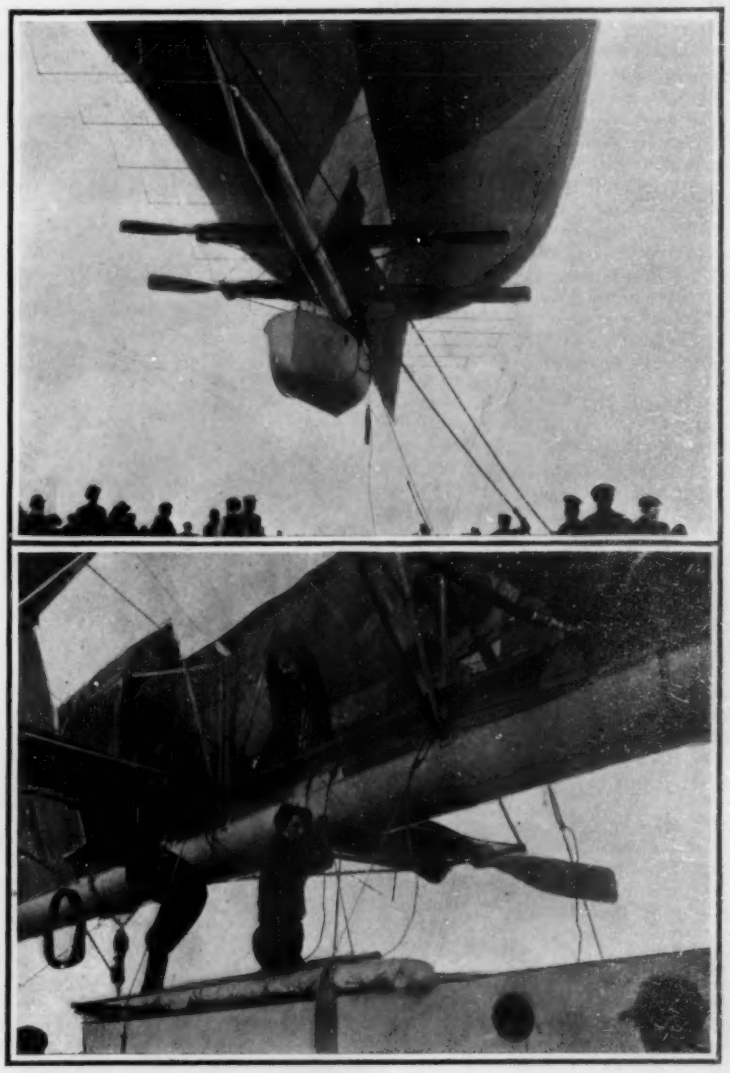
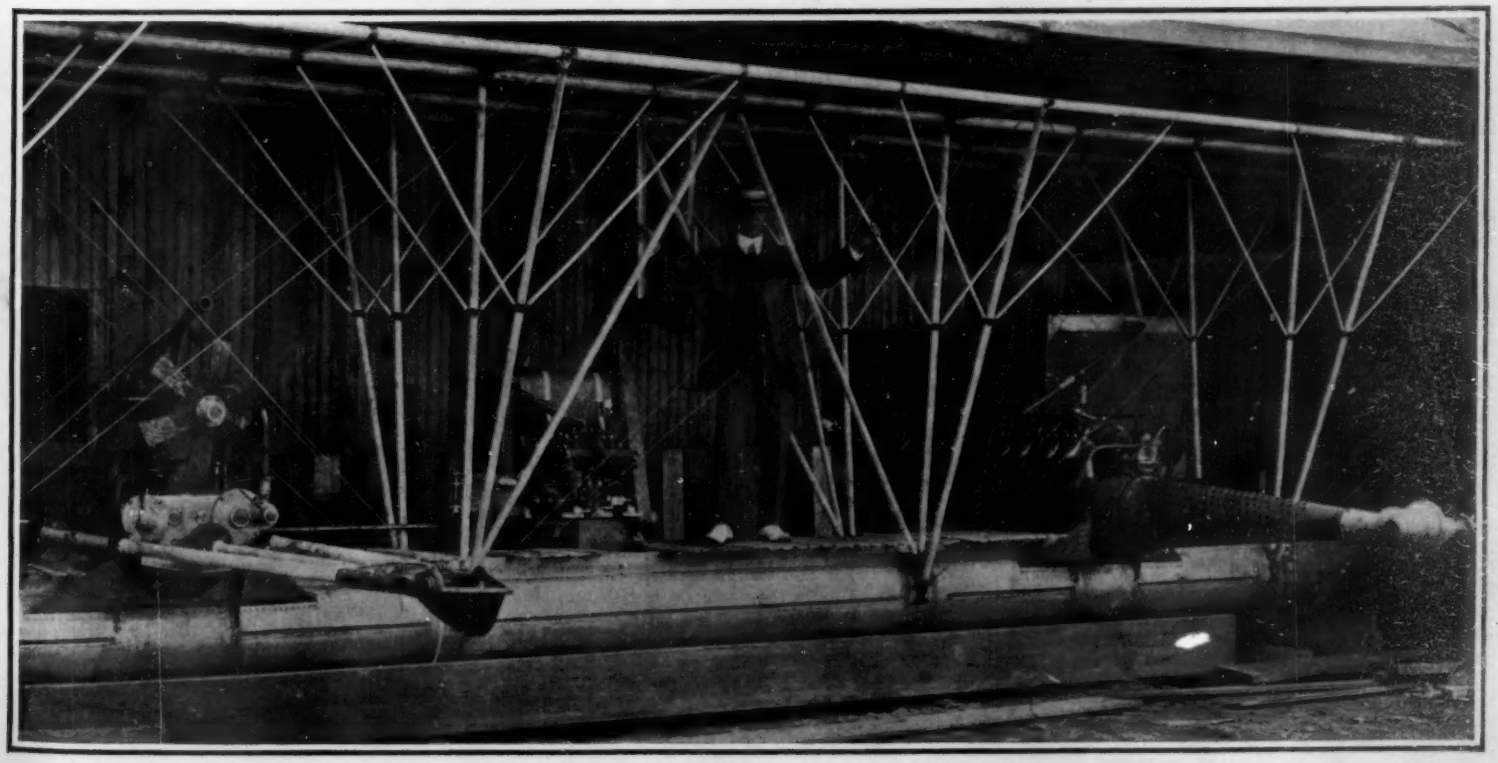
Looking down the car of the "America," Navigator Simon at the Wheel.



Photographs copyright 1910 by Edwin Levick.

Upper view.—Attaching the equilibrator to the airship. Lower view.—Fastening the lifeboat to the car.



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The three engines and the engineer of the "America." In the gear casing at the extreme right the trouble arose which disabled the after engine.

THE STORY OF THE WELLMAN OCEAN AIR TRIP.

THE HEAVENS IN NOVEMBER

BY HENRY NORRIS RUSSELL, PH.D.

THERE has been a good deal of general interest among the astronomical announcements of the past few weeks. It may first be recorded that Brooks's periodic comet was discovered at its present return by Aitken and Wilson at the Lick Observatory on October 1st. This faint comet has now been observed at four returns—1889, 1896, and 1903, as well as this year—and its orbit is accurately known. At its nearest point to the sun, which it reaches this time on the 8th of next January, it is slightly less than twice the earth's distance from the latter, while the remotest part of its orbit is a little outside that of Jupiter. It is a very faint object, but may prove of considerable theoretical interest; for Bauschinger, who has made a careful investigation of its orbit, finds that its period seems to be shortening slightly (after allowance is made for the action of all the planets). This may mean that, like Encke's famous comet, it meets with some resistance in its motion through space.

It may seem at first sight that this cannot be true, since the comet returns *sooner* than was calculated; but it can be shown that a slight diminution of the comet's velocity would necessarily make its orbit smaller, and this to such an extent that it would complete the whole circuit, even at the slower rate, in less time than formerly.

In the case of Encke's comet, which has been under observation for a century, the existence of some retarding force is beyond question. Prof. Backlund (of Pulkova, Russia) has shown that the retardation takes place in one definite region of the comet's orbit, and varies in amount at different returns; which makes it probable that here the comet's path crosses that of a swarm of meteors, which delay it by a sort of friction, whose amount is greatest when a denser cloud of meteors happens to be passing the junction at the same time as the comet. It will be of great interest to see whether Brooks's comet displays similar phenomena.

It should also be recorded that the discovery of two new stars within two weeks of one another has been reported from the Harvard Observatory. Both were found by Mrs. Fleming—who now has ten such discoveries to her credit—on plates taken at Arequipa, Peru. The first, in Sagittarius, must have appeared in the early part of 1910, being first found on a plate exposed on March 21st. It was at its brightest hardly above the eighth magnitude, and is now below the tenth. The second, in the far southern constellation Ara, was much brighter, reaching the sixth magnitude, and the date of its appearance is pretty closely fixed, a plate taken on March 19th, 1910, showing nothing above the twelfth magnitude where one obtained on April 4th shows the star distinctly.

Both stars showed the characteristic bright-line spectrum, and it is probable that, as in other cases, their sudden flashing out may be attributed to collision of a faint star with a nebula or cloud of meteorites. It may be added that both stars, as is usual in such cases, are well within the Milky Way.

Turning now to the general aspect of the heavens, we see from our map that in the early evening we may find the great square of Pegasus by looking almost overhead.

From its northeastern corner a line of bright stars extends far north and east toward the horizon. The first two of these with the adjacent corner of the square itself, belong to Andromeda. Our initial shows the form of that classic maiden, chained to a rock and in peril of being devoured by the monster Cetus, had not Perseus come to her relief; but little indeed of all this can be made out in the sky.

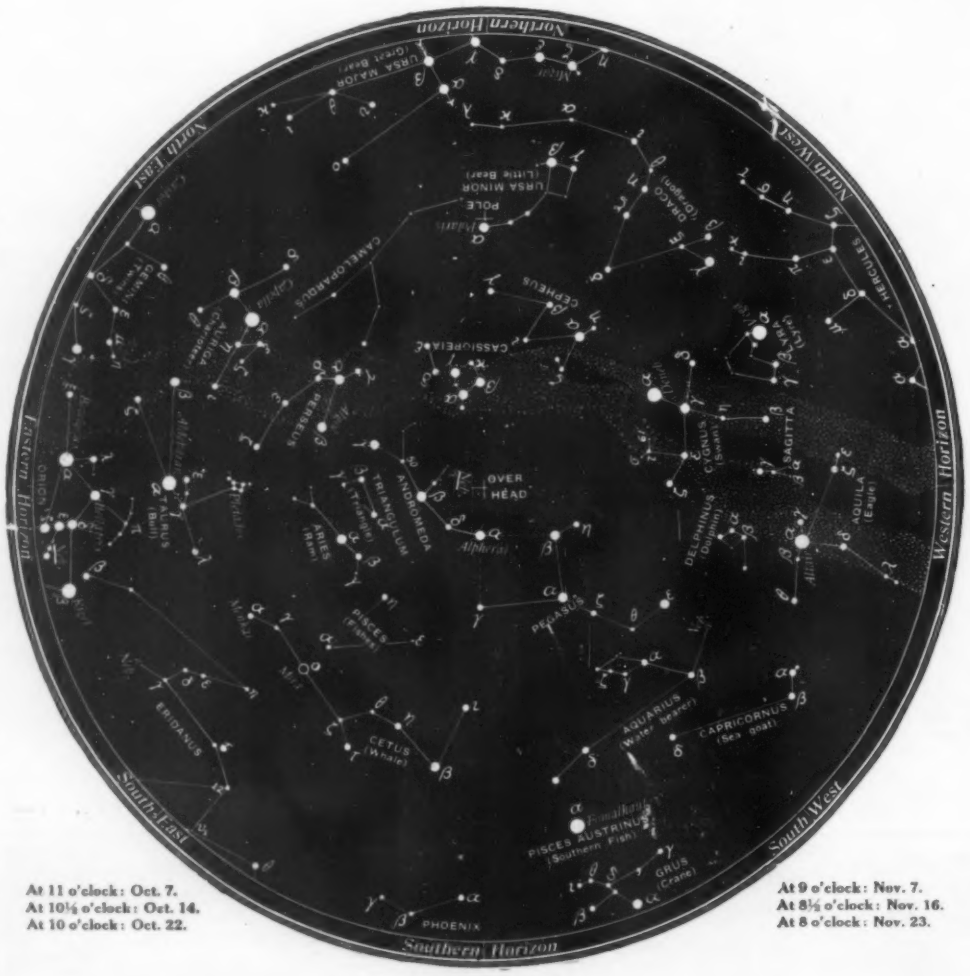
Two telescopic objects of unusual interest deserve mention here. The star Gamma (γ) is a very fine double, the contrasted colors of its brighter red and fainter green components being well seen in a small telescope. The companion is itself a close pair, in orbital motion, with a period of about fifty years, but is too difficult for small instruments.

About five degrees northwest of β Andromedæ is the Great Nebula of Andromeda, clearly visible to the naked eye, and one of the most remarkable things in the heavens. With the telescope, visually, the most notable features are the strong central condensation, and two dark lanes in the faint outer portions, which the photographic plate shows to be but portions of vast spiral rifts, extending through nebulosity too faint for the most part to affect the eye.

It has already been mentioned in these columns that the photographs of its spectrum show dark lines, such as would be given by a great cloud of stars like our sun. Mr. Ritchey's recent photographs with the great 60-inch reflector at Mount Wilson show in some parts of this nebula a tendency to break up into nebulous stars, not revealed with smaller instruments; and it may be that before long we shall be able to form some reasonably satisfactory theory of the nature of this vast and mysterious object.

Below Andromeda, in the east, is Aries, none of whose stars is as bright as the planet Saturn, which is now apparently paying them a visit. Taurus is lower, and Orion is rising, due east. Perseus and Auriga are well up in the northeast and Gemini is on the horizon. The Great Dipper is low in the north, Draco and Ursa Minor are below the pole on the left, and Cepheus and Cassiopeia are high up near the meridian.

Cygnus, Lyra, and Aquila are the most conspicuous constellations in the western sky. Nothing in the great barren expanse of the southern portion of the heavens compares with them; but the bright stars Fomalhaut, in the southwest, and Beta Ceti, some 30 deg. farther east, are prominent from their very loneliness.



At 11 o'clock: Oct. 7.
At 10½ o'clock: Oct. 14.
At 10 o'clock: Oct. 22.

At 9 o'clock: Nov. 7.
At 8½ o'clock: Nov. 16.
At 8 o'clock: Nov. 23.

At 9½ o'clock: October 30.

NIGHT SKY: OCTOBER AND NOVEMBER

THE PLANETS.

Mercury is morning star till the 12th, and then evening star, but is too near the sun to be seen at any time this month; and the same is true of Venus, which is in conjunction with the sun on the 26th. Mars is morning star, rising about 5:25 A. M. on the 15th, and is just visible in the morning twilight. Jupiter is close to him at the beginning of November, and the two planets are only about half a degree apart on the morning of the 4th. After this Jupiter falls behind Mars, though both are moving eastward after the sun, and at the end of the month he rises about 4:15 A. M. and is well visible.

Saturn is in Aries, just past opposition, and observable from dark till long after midnight.

Uranus is in Sagittarius, too low in the west at sunset to be well observable. Neptune, in the opposite quarter of the sky, comes to the meridian about 4 A. M. in the middle of the month, and may be observed by early risers if they possess powerful telescopes.

Two of the brightest of the asteroids—in fact, the brightest two of all these small planets—are now near opposition and observable in the evening sky.

Vesta, the nearer and brighter of the two, is apparently a little above the seventh magnitude, and Ceres, the other of the pair, about a magnitude fainter. Neither one is visible to the naked eye, but both may be identified with a good field-glass, by making a sketch map of the faint stars in the region where they are known to be, comparing it with the sky a day or two later, and picking out the asteroid by its motion.

Their approximate positions are as given below.

This puts the former about one-third of the way from α Piscium toward γ Ceti (at the beginning of the month), while at the end of November it will be about 12 minutes due south of the former star, and can easily be found. Ceres, on the other hand, is remote from any good guide stars.

The moon is new at 9 P. M. on the 1st, in her first quarter at midnight on the 9th, full during the eclipse on the 16th, and in her last quarter at 1 P. M. on the 23rd. She is nearest us on the 16th, and remotest on the 3rd, and again on the 30th. In her circuit of the skies she passes by Mercury and Venus on the 1st, Uranus on the 7th, Saturn on the 15th, Neptune on the 20th, Jupiter on the 28th, and Mars on the 29th.

The lunar eclipse already mentioned—a total one—is well visible in the eastern United States. The moon enters the earth's penumbra at 4:46 P. M. (Eastern Standard Time) and the shadow at 5:44. She is totally immersed in the latter from 6:55 to 7:47, gets clear of the shadow at 8:58, and of the penumbra at 9:56.

Almost the whole eclipse will be visible in the eastern part of this country, but only the concluding phases in the West.

	R. A.			Declination.		
	Nov. 5.	Nov. 21.	Dec. 7.	Nov 5.	Nov. 21.	Dec. 7.
	h. m.	h. m.	h. m.			
Vesta ...	2 16.6	2 2.7	1 54.4	+ 2° 19′	+ 1° 56′	+ 2° 17′
Ceres....	1 0.7	0 52.8	0 50.6	+ 7° 52′	+ 7° 19′	+ 6° 3′

Princeton University Observatory.

Many shops, states the American Machinist, are using photography as an aid to keeping an inventory of the machinery and tools. Views taken at different points make an unmistakable record of the number of machines in operation at that date.

Combination Gasoline Traction Engine with Ditcher Wheel Attachment

BY FRANK C. PERKINS

A combination gasoline traction engine and ditcher, of American construction, has recently been devised, which will do all sorts of farm or other work required of such an apparatus, at the same time being provided with a ditch-digging wheel attachment of great capacity. The accompanying illustration shows this ditcher and traction engine digging a trench 6 feet deep and 24 inches wide in Wisconsin clay at the rate of 4 feet per minute. The height of the digging wheel is 112 inches, and the width of the machine 10 feet, with a total length of 24½ feet. As a traction engine, the gasoline motor drives the machine at a road speed of 3 miles per hour, the engine developing 40 horsepower when required. The traction engine has a gasoline capacity of 70 gallons, and it also carries 10 gallons of lubricating oil, which is sufficient for operating at full load for three days.

In this combination type of traction engine and ditcher, if the digging wheel is taken from the machine, a perfect traction engine is left, and differs only from the best practice of traction engine builders in that it has wider traction, with increased strength to withstand the additional strain of the ditcher, and the operator can handle the machine as he would handle an ordinary traction engine.

For keeping the grade, a water glass is suspended on a swinging bracket at the side of the operator. This glass is connected by a flexible tube to a copper tank located on top of the digging wheel.

It is maintained that there are many advantages gained by using an especially adapted gasoline engine for a traction ditching machine. Steam power weighs 600 pounds to 800 pounds per horse-power, while a gasoline engine weighs 115 pounds per horse-power. Gasoline is compact and cheaper than coal, while no fuel is consumed during stops, and there is no expense for man, team, water, or coal wagon. The gasoline ditcher saves the expense of an assistant or fireman, and it does not have to be fired at night in freezing weather. The gasoline engine on this ditcher is of the horizontal two-cylinder type, developing full 40 horse-power.

It is stated that the cost of operation of a gasoline-driven machine is low, as only one man is required to run the machine, and two men can handle and lay the tile. The expenses of one 10-hour day is said to be for:

Operator	$4.00
Two ditch men at $2.50	5.00
25 gallons gasoline	3.35
Oil and lubrication	.50
Cost per day	$12.85

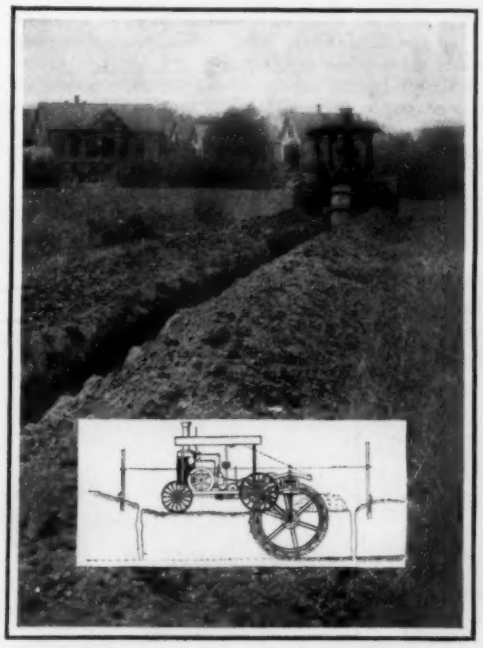
This continuous apparatus will dig a ditch 6 feet deep and 24 inches wide at a minimum rate of 180 linear feet (80 cubic yards) an hour. At this speed it digs 3 feet deep per minute, and over 100 rods per day.

It is held that a man will average barely 2 rods per day, digging 2 feet wide and 6 feet deep, while a gasoline motor-driven ditcher is more reliable than the man, and will dig 2 rods every 7 to 12 minutes. In 10 hours at the rate given above it evidently will do the work of nearly 60 laborers, and will keep so perfect a grade that tile may be laid behind it without further work on the bottom of the ditch.

It may be of interest to note the construction of this digging-wheel attachment, which is fitted in the rear and digs the ditch. It is 9 feet 4 inches in diameter, and is suspended from the rear axle by a cast-steel yoke or clevis. On the spokes is fastened an oval rim 22 inches wide, and on the center of this rim and around its complete circumference is riveted a 6-inch I-beam, while on the outer flange of this I-beam is bolted another oval rim 22 inches wide.

It may be stated that across the 22-inch outer rim, sixteen openings 6 inches wide are cut; and on one edge of these openings, cutting knives of hard center crucible steel are bolted.

Between these rims there are two continuous



A gasoline ditcher digging a trench 6 feet deep and 2 feet wide in sticky clay at rate of 4 feet per second. Inserted diagram shows side elevation of machine.

spaces or buckets, one on each side of the I-beam; and as the digging wheel revolves, the machine moves forward, while the digging wheel revolving upward causes each knife to shave from one-half to one inch of the ground.

It will be seen that as each of the sixteen knives takes its shave the earth is forced through the 6-inch openings, filling the continuous space or buckets between the rims, and in this manner from 8 to 16 inches of ditch are dug at each revolution of the digging wheel.

In disposing of the dirt, the wheel revolving upward carries the dirt to the top, and here there are stationary polished steel plows reaching from each side into the continuous space or buckets between the rims. These plows are made to fit the continuous space or buckets perfectly, and extend to and scrape the web of the I-beam. They are shaped much the same as the mo'dboard of a common plow, and the dirt coming in contact with them is deflected out and dropped on to the two circular conveyor tables. These conveyors are circular steel plates, and revolve like a turntable. At the outer edge, stationary scrapers force the dirt from the conveyors, dropping it at a convenient distance from the excavation. The conveyors are kept level automatically, and the earth is evenly divided on each side of the excavation.

The digging wheel is driven by a manganese steel sprocket, bolted in sections around the outside. It loosens the stones and hard earth, and protects the knives and rims from jams and wear, the sprocket also driving the conveyors.

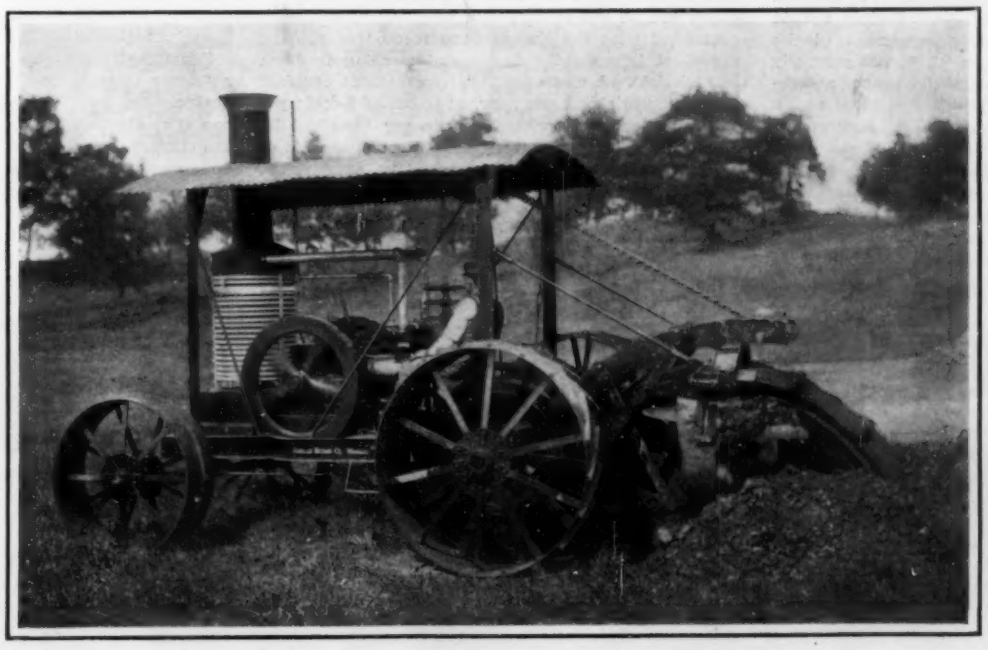
For use in sandy or caving ground a set of steel shields are utilized, so arranged as to be hooked to the rear of the wheel and to protect the man laying tile in the ditch in the same manner that curbing does.

Where a sloping ditch is desired for open work, or where the ground is inclined to cave, steel cutting blades are bolted at the sides of the digging wheel. The slope can be made from the width of the bottom of the ditch to 42 inches on top.

A wire cable or tape is stretched between stations, 11 feet above the bottom level of the ditch, and passes the water glass close enough to touch. The digging wheel is lowered to the depth required, and the colored liquid contained in the tank shows in the water glass on a level with the tape. As the unevenness in the surface of the ground is encountered, the slightest variation is noticeable in the liquid, which will at all times seek its level. The accuracy of the grade is very important, and it is held that there can be no surer or simpler method, as any bystander can determine at once the accuracy of the grade.

It will be seen that the operator handles the engine and control levers without shifting his position, and the wheel can be raised or lowered by engine power or by hand, as desired.

It will be noted that the dirt cut from the sides falls into the wheel, and is carried to the conveyors with that cut by the wheel, leaving as clean a sloping ditch as a straight one.



View of ditcher in operation of digging trench and disposing of material excavated.

COMBINATION GASOLINE TRACTION ENGINE WITH DITCHER WHEEL ATTACHMENT.

The Sun and the Weather.

In an article published in the September number of the Astrophysical Journal, Mr. W. J. Humphreys discusses solar disturbances and terrestrial temperature. He summarizes our present state of knowledge on the subject as follows:

1. An increase in sun-spots appears certainly to be accompanied by a decrease in terrestrial temperatures, at least in many places, fully twenty fold that which can be accounted for by the decrease in radiation from the spot areas alone. 2. It seems nearly certain that sun-spot maxima, whatever the value at such times of the solar constant, must lead to a decrease in the ultra-violet radiation that reaches the earth, and a corresponding decrease in the production, by this method, of ozone in the upper atmosphere. 3. The increase in the auroral discharges that accompany spot maxima tend to increase the amount of ozone, especially in the higher latitudes. 4. The change in the temperature of the earth, and all its train of consequences, from spot maximum to spot minimum, is not necessarily dependent upon a change in the solar constant. It may depend largely, if not wholly, upon a change in the absorptive property of the atmosphere, caused, we believe, by a variation in the amount of ozone produced by ultra-violet radiation and by auroral discharges.

Granite rocks are found throughout the Appalachian region, from Maine to Alabama, but have been quarried in the largest way in New England. Economically considered, however, granite is the most important kind of stone in the crystalline rock region of the Atlantic States south of the Susquehanna and is quarried in every State from Maryland to Georgia.

THE INVENTOR'S DEPARTMENT

SIMPLE PATENT LAW; PATENT OFFICE NEWS; INVENTIONS NEW AND INTERESTING

The Editor will pay for short articles available for this department

THE INVENTOR IN THE OFFICE.

BY JOSEPH B. BAKER.

Labor-saving machines may be divided into two classes: Those having a mechanical identity of their own, and those having the character of automatons. Certain machines which supersede human hands have their own different way of doing the thing; the inherent quality of mechanism, of acting rapidly and tirelessly and with an automaticity not delayed by thought processes, invites a radical departure from mere imitation of the primitive manual method. An instance is the writing machine, which is not a metal hand holding a pen, but a *type* writer operated by a keyboard, giving a speed and legibility far surpassing "handwriting." But in other instances the mechanism does imitate more or less closely the original movements of the hand, or of the hand holding a simple tool; and it is the object of this article to trace a few of these instances in labor-saving office appliances.

The number and variety of such devices are in marked contrast to the meager equipment of the "counting room" of former days, which was generally confined to a typewriter, a single telephone, a copying press, a gelatine-pad duplicating device, and a few punches, rubber stamps, and minor implements. Many of the devices now offered would be more widely used if some little shortcoming in efficiency or durability were corrected, or if the price could be lowered. The best results are obtained by care and system in the selection and use of mechanical office appliances, as in the adoption of other improved methods.

The handling of outgoing mail inclosed in envelopes is an especially active field for mechanical devices. Where large quantities of matter are sent out, the replacing of human hands by mechanism becomes not only advisable but necessary.

The folding of letters and circulars before slipping them into their envelopes is ordinarily done by hand; but when the quantity of matter requires the continuous labor of a definite force in folding papers, the time has come for a machine to step in. It pays to relieve even a single human worker of this monotonous drudgery. The folding machine is interesting to watch, as it snatches the sheets one after another, and passes each through a gang of devices to make the successive folds. Its work suggests the manual method in the way the sheets are centered preparatory to folding, and in the way the folded sheets are stacked in a neat pile, but is unlike it in the continuous motion of the sheet from one set of folding rolls to another, and in the celerity and accuracy of the work contrasted with the clumsy hand method of shifting the sheet between the hands and creasing it down in each fold. A small motor-driven machine can fold 6,000 to 8,000 sheets per hour, at a cost of 2 cents per thousand compared with 26 cents per thousand by hand labor. The accurate folding accomplished is of especial value in conjunction with the employment of transparent window envelopes, by which the addressing of the envelope is eliminated—the address written at the head of the letter itself serving to guide the letter through the post office by the folding of the sheet to bring this address just back of the window.

The communication once folded and inserted in its envelope, there remains the sealing and stamping of the envelope. The moistening of stamp and envelope flap, and the pressure necessary to make them adhere, are effected by devices of various degrees of complication, ranging from a simple hand tool for desk use to an elaborate motor-driven "mailing machine," used by those large business stablishments which handle as much mail as a medium-sized postoffice. A convenient hand sealer consists of a metal tool having a small tank of water in the handle communicating with a felt or sponge moistener at the end, the back being a smooth curved surface. With this implement the sealing and stamp affixing is a neat and simple matter of drawing the moistener over the flap and the stamp corner of the envelope, then turning the tool over and pressing down flap and stamp. A more elaborate hand machine has a receptacle for a long strip of postage stamps, which are fed over the moistener one at a time by the fingers of the operator, and then immediately applied to the envelope.

Departing from the small hand implements, there is a "stamp affixer" resembling a dating stamp of solid design. By inserting the envelopes in this machine one after another, and depressing the handle for each, the stamp is "licked" and affixed and at the same time counted. This machine holds a large number of stamps in strips, and prevents pilfering or misuse of the stamps. On a par with it in degree of mechanical elaboration and in efficiency is a simple rotary machine for sealing the envelopes. The operator turns the crank of the machine with his right hand, and

A machine for printing typewritten circular letters.

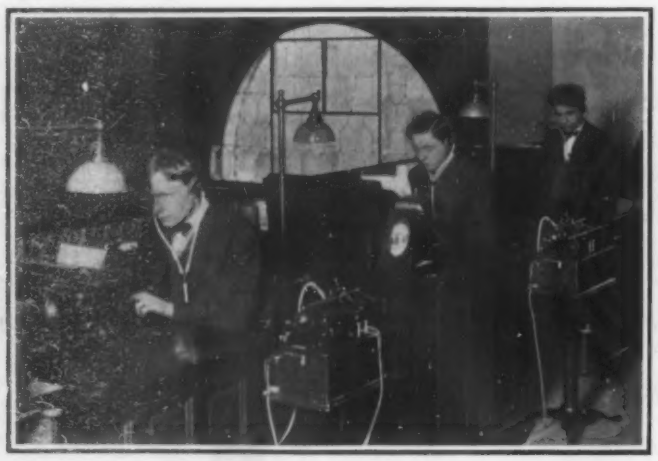
The unattended machine in the center is a "Multigraph," which makes facsimile typewriter letters. Typewriter type is held in grooves in a magazine, visible on left half of the machine. To the right is the printing cylinder to which the composed type is mechanically transferred, one letter at a time by means of a setting mechanism. An index on top of the machine indicates when any character is in position for transference. Printing is affected as a typewriter through a ribbon.

A novel typewritten-letter duplicator.

The Printograph, a multiple typewriter, which prints by typewriter action, through a typewriter ribbon with typewriter type like a standard typewriter so that it duplicates exactly the work of good operators on good machines at the rate of 2,000 to 4,000 letters per hour.

Reproducing typewritten letters by stencil.

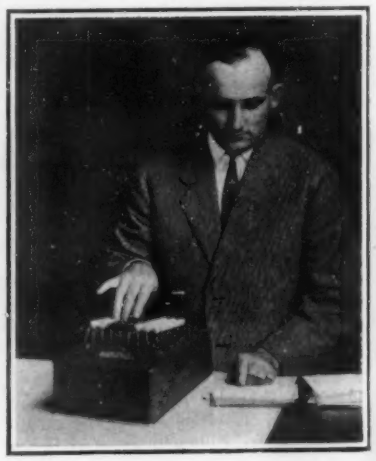
Rotary Mimeograph. A waxed stencil is used, previously perforated on an ordinary typewriter with the letter to be written. The stencil is wrapped around a cylinder and is inked from the inside of the cylinder. Paper is under the cylinder. One turn of the crank causes the delivery of a single printed sheet.



An application of the phonograph to office dictation.

The use of talking machines as a substitute for the stenographer in office work has been steadily increasing and to-day there are many thousands of them in daily use throughout the country. They offer to the man whose time is valuable the advantage of being able to dictate whenever he pleases, as rapidly as he pleases and with the certainty that what he has dictated can be reduced to writing by any intelligent person who can hear and write. The convenience of being able to dictate in private without having to call a stenographer or interfere with the duties of an employee is of itself incalculable.

These pictures show Edison business phonographs in actual use in the offices of the Prudential Life Insurance Company.



A non-listing adding machine.

The "Comptometer," a non-listing machine which adds, multiplies, divides, extends and checks bills etc., figures percentage. Any number of keys in different columns may be struck simultaneously, so that as many figures can be added with one stroke as can be reached by the fingers of both hands.

THE INVENTOR IN THE OFFICE.

holding a pack of about twenty-five envelopes with their flaps all facing the same way with his left hand, he hooks them in succession, by their flaps, onto a slide. The machine picks up each envelope, carries it past moistening rollers, turns over its flap, and then passes it between sealing rollers, which eject it into the mail basket. Envelopes of all sizes, without special adjustment, are handled at the rate of 6,000 per hour.

The mailing machines combine the functions of the separate stamp-affixing and flap-sealing devices, delivering the prepared mail packed in bags for the post office. In a typical machine for this work the bunches of open, unstamped envelopes are deposited in a tray, from which they are taken in convenient packs and held against an automatic feed which slips off one envelope at a time, and passes its flap over a metal moistening disk continuously revolving in a water-bath. Meanwhile a strip of stamps is being fed forward, and at the right moment the end stamp is cut off, moistened, and affixed. The flap is then laid down, and the envelope passed between rollers, automatically counted, and stacked.

The automatic cashier or change-making machine, used by busy bank-tellers, pay clerks, and other employees whose work includes the handling of large amounts of fractional currency, is a mechanism which strikingly imitates finger movements in picking up coins, but which operates with far greater speed and accuracy than it is possible to maintain by the primitive method. These machines consist essentially of a keyboard of numbered finger keys and a receptacle for coins of different denominations held in trays—a separate pile of coins for each denomination. Depressing a key shoves the bottom coin of one or more piles out from its fellows, to make up the amount represented by the number of keys depressed. In a recent type each transaction is effected by the depressing of a single key, without requiring any mental calculation, there being two forms of the machine, a "payer" and a "changer." In the former, depressing key number 38, for example, causes mechanical fingers back of the 25-cent piece, the dime, and the cents trays to shove out the minimum number of coins—five in this instance—necessary to make up the amount, and the coins drop through a spout into the hand of the operator or into a pay envelope. In the changer, depressing the same key as before causes coins amounting to the difference between 38 cents and a dollar (62 cents) to be culled from their respective piles and delivered through the spout.

Adding or calculating machines are indispensable in any large counting room. In these machines the operator sits at the machine just as he would at a writing table; but instead of setting down figures with pencil and paper, manipulates keys and levers, the interaction of which performs the whole of the mental work for him. The so-called key-set machines show visually the result of the mechanically performed computation on a row of dial wheels, or imprinting ("list") it on a paper strip. Most of them are operated by the fingers of one hand spread over a keyboard of keys arranged in rows corresponding to ten decimal places, and the depressing of keys in different rows parallels the setting down of written numerals in the corresponding decimal places on a ruled ledger sheet. In a recent adding and listing machine having a keyboard of only nine keys, the mechanical expression of decimal position, in a list of numbers to be added, is attained in a manner still more strikingly imitative of the setting down of a column of written figures: an auxiliary space bar being used, which "makes" the effective decimal position of each number just before it is written. In writing the number 36,928, for example, following and to be added to the number 547, whereas with the pencil method the numeral 3 is set down two places to the left of the numeral 5 of the number already written, the 6, 9, 2, and 8 being then set down in order following, on the adding machine the proper decimal positions of the 3 and of all the following numerals are allotted before depressing the numeral keys by depressing the back space bar twice.

The signature machine, a machine for enabling a signatory official to sign from ten to twenty checks, stock certificates, or other documents at a time, writes like a muliple human hand. The ten-signature machine consists of a dummy or "monitor" pen, which the signatory holds in his hand like an ordinary pen, but which is attached by a flexible joint to a light aluminium pantagraph frame free to move in every direction in the horizontal plane because supported on nearly frictionless roller bearings. The monitor pen itself does no writing, but every motion imparted to it by the hand is followed by each of ten fountain pens which are carried on the frame, so that the writing movement results in ten signatures written in the time ordinarily required for a single signature. In order to realize the speed thus attained, in the signing of thousands of checks, for example, the latter are handled in the form of sheets of checks, which are laid in piles on the writing surface and removed one at a time, as signed, by an assistant. In this way a signatory can get through what would ordinarily be several days' work in a single hour. Using a twenty-pen machine, a signatory of the United States Steel Corporation was able to sign up the entire dividend list—the largest in the world—at the rate of over 5,000 checks an hour; and on a stop-watch trial a record of 5,000 signatures in 28 minutes 10 seconds was established.

In this machine the moving frame carrying the battery of pens has considerable inertia, though built as light as possible, and some practice is required on the part of the signatory to get the right "swing." In the nature of things, the machine would never be used in large numbers, and therefore its improvement is not of very great importance; but it is interesting to imagine that the principle of the telautograph might be used to avoid the inertia (inevitable where the pens

An addressing machine.

Rapid addressing machine adapted for hand feeding of cards, envelopes, bill-heads, etc. Printing is done through a parchment stencil perforated on the Beiknap stencil machine, which is a typewriter provided with pin-point type. Stencils are placed in a magazine on top of machine and automatically carried over the inking and under the printing platen.

A key-operated calculating machine.

The "Mechanical Accountant," a brain-saving device distinguished by a low keyboard and key type so tilted that they are in full view of the operator. The sight apertures are also arranged for convenient inspection. There is no lever to operate. The machine does every possible kind of arithmetical work. It is non-listing and automatically checks the correctness of the operator's work item by item.

A substitute for the penknife.

A pencil sharpener cutting somewhat on the principle of a penknife, but more expeditiously and neatly and without breaking the lead point. Dull knives can easily be renewed at a cost of about 16 cents each after 1,000 pencils have been sharpened. Only enough wood is cut away to sharpen the pencil.

A mechanical brain.

The "Millionaire" calculating machine, which can be used for every possible calculation used in modern business. The machine constantly corrects the operator. Only a single turn of the crank is necessary for each figure in the multiplier or quotient.

The carriage containing the multiplier and product rows, shifts automatically.

The two factors always appear in two straight lines just above the product, thus affording an easy check on each calculation.

Any amount set up on the marker slides, appears in a straight line directly underneath, allowing an easy check by the operator.

A machine that signs checks and bonds.

A machine which writes 5,000 signatures in an hour.

The reciprocating framework, with the pens, is controlled by a Monitor handle, by using which, the writer affixes ten original signatures to the ten checks in two of the compartments beneath the pens.

The compartments in rack will hold 2,500 checks, or 500 in each, and as the refilling is a matter of a moment only, practically no interruption to the work ensues when more than 2,000 are to be signed.

A mechanical envelope sealer.

The lower edge of a bevelled metal roller turns in a water tank and carries on its surface just sufficient water to moisten the gum.

The envelope flaps are rapidly, one after another, hooked onto the slide in the position indicated in the picture.

By turning the crank with the right hand each letter is quickly picked up by the moistening rollers, is carried on and sealed as it passes through the sealing rollers at the right hand end of the machine.

Letters are sealed at the rate of 6,000 per hour.

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are moved mechanically by the writing hand) and at the same time largely increase the number of signatures that it would be possible to make at the one writing by employing a corresponding number of electrically connected receiving instruments.

The automatic typewriter operator, for reproducing "form letters" by writing them individually, character by character, on a typewriter, instead of printing them by any of the stencil or type-duplicating processes, is an actual automaton. This machine is placed over the keyboard of a typewriter, and handles the same just as a human operator would do; but with not only the greater speed that the employment of a machine gives, but with a gentleness and smoothness that compare favorably with the work of the average human typist, and that prolong the service life of the typewriter.

The typewriter operator is worked by electro-pneumatic mechanism, a small electric motor being the primary source of power and driving an air-compressor, and the striking of the keys, spacing between words and between lines, shifting of the carriage, etc., being deftly and accurately effected by mechanical and pneumatic attachments. The control of this automaton is by a perforated "master sheet" of tough paper, which is required for each form letter to be written and which is made on a perforating machine separate from the typewriter operator proper. This sheet is the guiding pattern for the body of the letter, and the addresses are taken care of in the same way by another perforated sheet, or roll. The perforating machine has a regular typewriter keyboard, but the depressing of each key, instead of printing a character, punches a small hole in the paper in a determined position on the sheet, somewhat on the principle of the music-roll of a self-playing piano. When the letter sheet and its accompanying roll of addresses have been slipped into place in the typewriter operator, and a quantity of letter-heads placed in position in a rack over the feed rolls of the typewriter, the turning of a lever starts the writing. The machine, operating the typewriter, abstracts the top sheet from the pack of letterheads, rolls it into aligned position, writes the date, shifts the carriage back, and spaces down to write the address, and then proceeds with the body of the letter. Once started, the machine rattles away, turning out letter after letter at higher speed than the most expert human typist could attain. Each letter is a perfect copy of the master original without the slips and errors to which human typists are especially liable in the monotonous drudgery of mere copying.

It is obvious that since by this automaton typist each letter is *written* from beginning to end (not printed), the much-desired appearance of an originally dictated and individually written letter is preserved. The ordinary earmarks of a form letter—imperfect "matching in" of the address, imperfect alignment, non-uniform inking, etc., which are easily detected in printed letters, by the practised eye, are of course avoided. A feature which greatly enhances the impression, given by the letter, of having been individually written in the ordinary way from dictation, is the plan adopted of following each address on the master address roll with its own salutation; allowing the different salutations to be varied to suit individual circumstances: "Dear Sir," "Dear Madam," "My Dear Mr. Smith," etc.

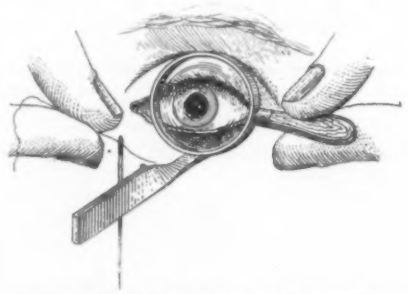
Of the many pencil sharpeners that have been put on the market, at least two imitate the manual operation of sharpening the pencil with a pocket-knife or other blade. One type of crank-operated, geared machine is equipped with three revolving knives, which work on the pencil, taking off one shaving after another while the pencil itself is rotated slowly in the chuck, thus simulating the ordinary hand method. In another recent machine of simple design, weighing only eleven ounces, the usual rotary principle is departed from, and the wood and lead are cut away by a reciprocating blade carried on a rocking arm and operated by simply pushing it downward. This handy little machine therefore does not have to be clamped to any support, but may simply be laid on the desk or table, where it serves as a convenient paper weight.

The advantages of pencil sharpeners are largely offset at present by the dulling of the blades in use, and these little machines would probably be much more widely used if their makers could follow the example of the safety razor companies by working out some convenient system of sharpening or renewing the blades. In one machine at least extra blades can be bought and inserted.

An attorney in active practice says it is quite common for manufacturers to continue for years the payment of royalty for the use of a patented invention before they discover that the device is not within the scope of the patent relied on. He cited particularly a case in which New York city manufacturers of wearing apparel are now paying royalty on a garment which is not only not covered by the patent specified in the royalty agreement, but was expressly excluded from the case during the course of the application through the Patent Office.

ODDITIES IN INVENTIONS.

Needle Threading Device.—To permit of threading needles readily, an inventor has devised a simple contrivance consisting of a magnifying glass with a spring clamp attached thereto in which the needle may be held. The clamp is formed of a strip of metal



MAGNIFIER FOR THREADING NEEDLES.

bent upon itself and providing a long channel in which the needle may be secured and adjusted to the proper focal distance from the lens. The illustration shows how the device is used, the eye of the needle being greatly magnified so that it is a simple matter to pass the thread through it.

Improved Fish Hook.—In order to make sure of catching such fish as merely nibble on the bait and do not become firmly hooked thereon, an inventor residing in St. Louis has devised a hook, such as is pictured in the accompanying engraving. It will be observed that it consists of two parts, one of which carries the bait and is suspended from the other part that consists of a gaff hook. A small float of cork or similar suitable material normally holds the gaff hook in its raised position as shown by full lines in the illustration. When a fish nibbles the bait, whether it is caught by the bait hook or not, it causes the gaff hook to descend to the position shown by the dotted lines. As the gaff hook descends, it strikes the fish between the eyes, rendering escape impossible.

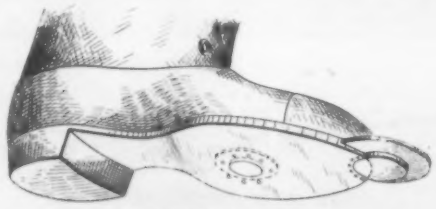
COMBINED BAIT HOOK AND GAFF HOOK.

Novel Vacuum Cleaning Apparatus.—An ingenious form of vacuum cleaner has recently been patented, which consists of a suction fan operated by a water motor that may be attached to the ordinary kitchen faucet. A tube is connected with the chamber of the

WATER-DRIVEN VACUUM CLEANER.

suction fan and this terminates in a suitable nozzle or foot plate which may be moved over a carpet or rug to draw out the dust and dirt therefrom. One of the advantages of this system is the fact that the dirt drawn up by the suction fan may be carried away with the water down the kitchen drain.

Patch for Shoe Soles.—An inventor has recently devised a patch of peculiar shape which may be applied to any part of a shoe sole that has worn through and be secured without nails or tacks. The patch which is shown in the illustration consists of a disk of the same thickness as the sole at the center and surrounded by an annular flange that tapers toward the outer edge. Supposing the sole has been worn away at the toe, the sole is cut away to conform to the



PATCH FOR SHOES.

body portion of the patch. The patch is then fitted on the sole in the manner shown in the illustration, the flange serving to press out the worn leather and render the sole of a uniform thickness. After the patch has been secured by sewing, the projecting part is cut away. In the case of a hole worn in the center of the sole, the patch is moistened so as to render the flange flexible and permit of inserting it through the hole so that it will press out that part of the leather surrounding the hole which has been worn thin.

Brief Notes on Patents.

Of the twenty-seven former Commissioners of the Patent Office, it is believed only five survive, being Messrs. Spear, Mitchell, Seymour, Duell, and Allen. Of these, all but one, strange to say, are still in active practice before the Patent Office.

Nearly one-third of all the patents issued by the United States were granted during the last ten years. The last patent issued during the year ending June, 1900, is numbered 652,737, and the last patent issued during the year ending June, 1910, is No. 963,027, being an increase in ten years of 310,290.

The full dinner pail, of which we have not heard so much recently, is also a stove in a patent granted to David H. Morrell. At the bottom of his dinner pail is an oil burner, above which a receptacle is carried, divided into separate compartments for different kinds of food. The compartments are separated from one another, so that the fumes arising from one cannot affect the contents of another.

For lack of an overhead shower bath, the hand spray is widely used. Ralph R. Sandham, of Harlan, Iowa, if we may judge from a patent which has recently been issued to him, objects to holding the hand spray. He has devised a rigid, bow-shaped frame which is to be connected with the water-supply pipe. The free ends of the frame are provided with spray nozzles. You sit within the frame, and are sprayed from both sides at once.

For the first time in its history, the Patent Office is now utilizing the basement of the Patent Office building as offices for its examiners' division, two divisions, those in charge of Principal Examiners Cowles and Benson, being now located in the basement of the west wing of the building. This is another evidence of the crowded condition of the Office, and emphasizes the necessity of a new building, devoted exclusively to the interests of the inventor.

The United States Patent Office has among its force a number of civil war veterans, including two medal of honor men. These are Principal Examiner C. G. Gould and Chief Draftsman Alexander Scott. Major Gould won his medal for gallantry in the rifle pits before Petersburg, and Capt. Scott in action at Monocacy, saving the two flags of the regiment. Both are native Vermonters and were connected with the volunteer forces of that State, although in different regiments, and both were wounded in action.

Legal Notes.

The Register of Copyrights has denied the application of the city of Wilkes-Barre, Pa., for a copyright of its name. It is a well-known principle of copyright law that a mere name cannot be copyrighted.

E. Rostand's play "Chantecler" involved an interesting legal decision. In the case of Frohman and others against Morris (Incorporated), and others, 123 New York Supplement, 1090, it is held that the word "chantecler" is not of such a descriptive character as to preclude its exclusive appropriation. The court, in granting an injunction against the use of the word "chanteclair" as the title of a burlesque in which most of the characters were barnyard fowls, said that though no one intending to witness plaintiff's play would possibly mistake the defendant's performance for it, still the power to distinguish would not save the playgoer who had gotten into the wrong theater, as his money would be spent and his evening irretrievably lost. The decree, however, did not interfere with the production of the play under the title of "The Barnyard Romeo."

An obstruction like dirt on a boy's face is merely matter out of place in the opinion of Judge Monroe of the Supreme Court of Louisiana. The court holds that that which may be a stepping-stone when in a position where it is needed and can be used as such becomes an obstruction when occupying a place intended for other use where it is not needed and cannot be so used. In the same case, McCormack versus Robin, 52 Southern Reporter, 779, the court holds that the feminine habit of putting on gloves between the front door and street car does not exhibit such reckless disregard of danger to life and limb as to preclude the recovery of damages for injuries resulting from the failure of those whose duty it is to keep the way free from obstruction; a person walking along a street or sidewalk not being expected to exercise the care which would be required in traversing a jungle.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

HAT-PIN.—G. W. MOORE, Weehawken, N. J., and J. K. HUTCHINSON, New York, N. Y. In this case the pin is normally retracted into a position such that it cannot injure the user or another person, and which can be easily forced through a hat or other fabric, as the point assumes a projected, operative position when the end of the sheath is pressed against the fabric through which the pin passes.

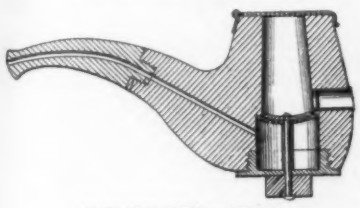
TROUSERS-STRETCHER.—Y. TAKANO, Atlantic City, N. J. This invention refers to a stretcher of a type which is adapted to suspend the trousers from a suitable support, at the same time stretching out the wrinkles and forming creases along the proper lines. The device will automatically put a tension on the trousers material when once adjusted.

Of Interest to Farmers.

DOUBLE RAKE.—R. M. KENNEY, Clinton, Oklahoma. The rake is of the kind operated by aid of horses or other draft animals, the more particular aim of the inventor being to facilitate the handling of the rake heads by the driver while the latter occupies his seat upon the device. The patent makes certain specific improvements over the construction of a rake described in a former patent granted to Mr. Kenney.

Of General Interest.

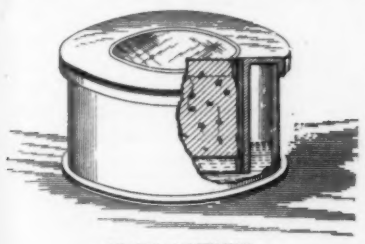
TOBACCO PIPE.—GEORGE P. TOBIAS, Willow Springs, Mo. The pipe is so arranged as to protect the tobacco from air currents and moisture, retaining it in a perfectly dry condition, thus insuring a cool, dry smoke from the first whiff until the charge of tobacco is



IMPROVED TOBACCO PIPE.

exhausted. The arrangement permits of consuming every particle of tobacco in the pipe. Saliva is prevented from entering the bowl, and the design is such as to prevent any biting of the tongue.

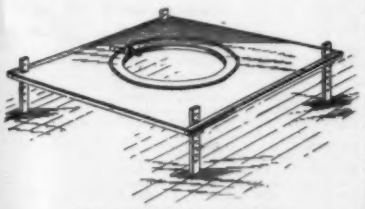
STAMP-MOISTENER.—JAMES G. SUMMERS, 408 Traslow Street, Charleston, W. Va. This improved stamp moistener is of novel construction, and is adapted to be used on a desk. It comprises a sponge cup, a cup holder, and a main casing, so constructed as to permit of



STAMP MOISTENER.

easily refilling the moistener with water. The water is fed to the sponge automatically, so that the sponge is always ready for use. The construction may be clearly understood by reference to the illustration, which shows part of the casing broken away.

SKIRT-EVENER.—MRS. M. E. ARCHER-BURTON, Berlin, Md. The object of the invention is to permit of determining accurately the required length of a skirt by marking it along the bottom. It consists of a platform, with a central opening, in which the person whose skirt is to be marked stands. A small marker



IMPROVED SKIRT-EVENER.

is located on the platform at the edge of this opening, and as the wearer turns about, the skirt is drawn past the marker. Thus, if desired, the marking of the skirt may be effected without the aid of an assistant. The apparatus may be packed compactly, for the purpose of storage or shipment.

BOOKBINDER'S GLUING-PRESS.—J. GIESECKE, B. F. NEBERGALL, and G. F. OHEIM, New Braunfels, Texas. Among the principal objects which the present invention has in view are: To provide a bench press constructed and arranged to compress the binding on the body of a book, and on three sides thereof simultaneously; to provide a press which is adjustable to accommodate books of various thicknesses, which is simple and durable.

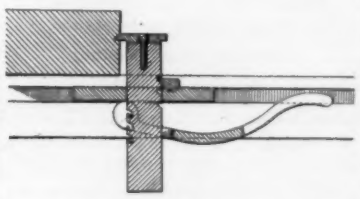
CIGAR.—F. J. CUDA, New York, N. Y. This invention is an improvement in providing means at the tip of a cigar to facilitate smoking. A cigar prepared according to the present patent does not differ in any way in outward appearance from any other cigar, while the improvement obviates in a most effective way the troublesome biting or cutting off the tip before the cigar can be smoked.

MAGAZINE-HOLDER.—B. F. HAYES, Lowell, Mass. The invention is a magazine holder by which the modern heavy magazine may be conveniently grasped and supported while reading, and belongs to that class of such devices as embody a tubular hand-grip of spring metal split lengthwise and having opposed longitudinal jaws at the edges, arranged to firmly bind on the opposite sides of the magazine adjacent to the rear edges.

FIRE-ESCAPE.—J. SCULLY, Minneapolis, Minn. By means of this invention persons in danger from fire can easily escape from different floors of the building. It is operable in a substantially horizontal direction so that the platform can be positioned at different tiers of windows, and it is so constructed that in case of panic the fire escape cannot be overcrowded by those seeking escape by means of it.

Hardware and Tools.

ADJUSTABLE BENCH-DOG.—JOSEPH FLETCHER, Brick School, Enfield, N. C. Pictured in the accompanying engraving is a bench dog which is adjustable along the length of a carpenter's bench, and may be elevated to any desired degree, and is also provided with a lever by which the bit of the dog may be



ADJUSTABLE BENCH-DOG.

forced forward and down into the work and the dog be clamped in place. The dog is carried on a clamping block, which is adjustable in an undercut slot. The slot permits shavings and chips to drop through without interfering with the adjustment of the dog.

LOCK.—J. B. HOOVER, Elizabeth, N. J. This lock may be readily used for locking coats, hats or other garments, or umbrellas or other light articles to any kind of a hook, nail or other hanger. These when secured in place by this combination lock cannot be removed save by one knowing the combination. It is comparatively small and may be easily carried in the pocket or a bag, so as to be always ready for use.

SAW-FITTING DEVICE.—C. R. PIERCE, Rainier, Wash. This tool has means for accurately fitting in working order both the cutting and raker teeth of the saw, the same comprising, with reference to the cutting teeth, a jointer serving to file off the points of the teeth on a regular line, a side dresser for the teeth and a scriber for drawing the pitched lines at opposite sides of the teeth, whereby they may be filed to a uniform bevel, and comprising, with reference to raker teeth, a pointer to enable them to be filed on the angle to uniform length, and a gage to show when the teeth have been properly swaged.

Household Utilities.

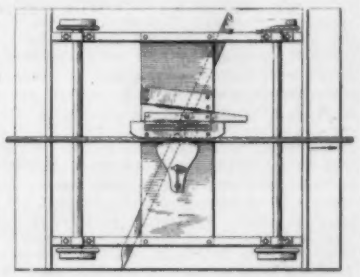
COOKING APPARATUS.—L. R. DAVIS, Riverside, Cal. This apparatus may be used in connection with gas, oil or other cook stoves for food and the like, and permits of different kinds being prepared simultaneously, which effects a saving in fuel owing to conservation of the heat used in cooking, with which cooking vessels of different kinds can be employed and by means of which food can be thoroughly and hygienically cooked.

FOLDING-BED.—L. B. JEFFCOTT, New York, N. Y. The intention here is to provide a folding bed arranged to permit of holding the mattress and bedding extended in a horizontal position, or one end extended to an inclined position, or to allow of completely folding the bed, when not in use, into a small space, at the same time accommodating the mattress and bedding between the head and foot rails of the bed.

Machines and Mechanical Devices.

SHEARING DEVICE.—S. L. HARWOOD, Dublin, Ga. The object of this invention is to provide a device designed especially for cutting cotton ties or heavy work by light power. Further, to provide a reversible and an interchangeable blade, which may be easily inserted in place and removed, and which when one edge is dulled may be reversed to bring the other edge into cutting position.

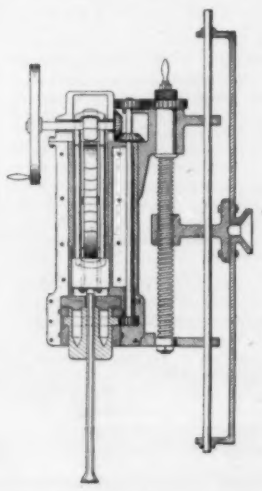
AUTOMATIC CLUTCH AND RELEASING MECHANISM FOR CABLES.—ADDIS J. DUNTON, Ketchikan, District of Alaska. The purpose of this invention is to provide a device which, when set in motion, will automatically grip a traveling cable, so as to permit of



CLUTCH AND RELEASING MECHANISM FOR CABLES.

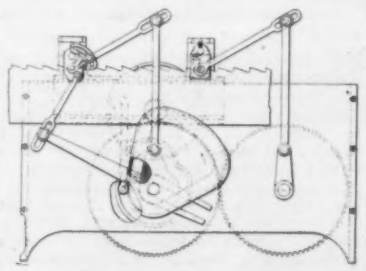
drawing a car along the cable way. The gripping member will positively hold the cable, regardless of the direction in which it is moving, and the greater the pull, the tighter will be the gripping action. A simple releasing device is provided.

POWER ROCK-DRILL.—S. S. STEVENSON, Garza, Garcia, N. L., Mexico. The invention here illustrated consists of a rock drill which may be operated by hand. The driving shaft carries a hand wheel, and a four-leaf cam, arranged to lift a hammer four times per revolution, by engaging a pin carried by the hammer. The drop of the hammer is emphasized by a spring, the recoil of which assists the next leaf or wiper of the cam to raise the hammer.



POWER ROCK-DRILL.

AUTOMATIC SWAGING AND SIZING MACHINE.—ALBERT D. CAVERNO, Windsor Locks, Conn. This machine is automatic in its action and may be adapted for saws having teeth of



AUTOMATIC SWAGING AND SIZING MACHINE.

various sizes and spacing. When once set, the saw teeth will be swaged uniformly and the teeth will be pressed to the same thickness by means of automatic dies. The dies are operated by power, and the amount of travel of each die can be so regulated that a tooth of uniform size can always be produced.

LATHE ATTACHMENT.—W. C. RIEHS, San Rafael, Cal. The object here is to provide an emery wheel attachment for use with any lathe which may be easily connected and disconnected, and which will be easily operated. It consists of a support provided with spaced bearings, a shaft journaled in the bearings, and provided with an emery wheel, and a tongue connected with the support for engaging the tool holder of a lathe.

MOISTENING-ROLL.—A. FACHS, New York, N. Y. This improvement is for use in machines employed for moistening gummed tape, and arranged to securely hold the sponges or other water absorbing material in place and to readily give off sufficient moisture to the gummed side of the tape on drawing the latter over the peripheral face of the roll to thoroughly moisten the said gummed side.

ADJUSTABLE PITMAN.—C. VOGEL, Seward, Neb. This invention has reference to an adjustable pitman, especially adapted for connecting the power beam of a forging hammer to the driving shaft. The design is to connect the beam of the power hammer to the crank on the driving shaft mounted in bearings upon the upper side of the base of the hammer.

TAMPING MACHINE.—H. D. MORGAN and H. SCHOBY, Plain City, Ohio. The machine is for use in road-making and for like purposes, and relates more particularly to a machine of this class in which movable tampers are used for compacting earth or other road material, and have associated therewith means for raising and lowering the tampers, and means for otherwise actuating them, so that while they are in contact with the surface of the ground they are undergoing no horizontal movement.

Prime Movers and Their Accessories.

SPRAYING DEVICE FOR INTERNAL-COMBUSTION ENGINES.—H. W. POGUE, Decatur, Ill. The purpose of the inventor is to provide a device for injecting a spray of explosive mixture into the cylinder of the engine where it is exploded, to start the engine, thereby dispensing with the necessity of turning the crank shaft of the engine to start the same.

ROTARY ENGINE.—V. L. CARWELL, Dorrancetcn, Pa. In this case the invention relates to an engine of a type in which the operating fluid is adapted to act directly on a vane or piston attached to a crank, and which is provided with a plurality of compound cylindrical valves for controlling the supply of operating fluid to the piston.

Railways and Their Accessories.

CAR-SEALING DEVICE.—E. L. PITTS, Yuma, Ariz. By means of this device a complete record may be kept under lock of when and by whom the car is loaded, of each opening of the door, and the place of opening and wherein it will be impossible to open the door without leaving such record in the receptacle provided.

CAR-SEAL.—F. L. SHADLEY, Sterling, Neb. Mr. Shadley's invention relates to self-locking car seals and has for its object the production of a simple and efficient device which shall provide absolute security. The improvement is a cheap and positive seal which can only be opened by destroying the same, so that tampering with it will be readily discovered.

CAR-TRUCK.—J. E. SIMPSON and W. D. PUCKETT, Portsmouth, Ohio. This invention refers to car trucks for use with railroad and other cars, and has reference more particularly to the combination of independent axle spindles, each having a wheel, bearings for journaling the spindles, and a common member for securing the bearings to a car, the wheel being so designed that no machine work is necessary upon it.

Pertaining to Recreation.

SAFETY BASE-BALL-SHOE PLATE.—E. KINZEL, Albany, N. Y. The invention pertains to a plate to be attached to an athlete's shoes to aid him in maintaining a quick start when standing on yielding ground. The spikes of this safety plate may be readily renewed when worn out

PORTABLE BOWLING-ALLEY.—J. E. NOONAN, New York, N. Y. The improvement pertains to game apparatus, and the aim is to provide a new and improved portable or parlor bowling alley, adapted to be set up and accurately leveled on a floor or other support, and arranged to permit of playing the game of ten pins by the use of balls thrown by the player.

GAME APPARATUS.—G. N. BIL, Jersey City, N. J. The purpose here is to provide an apparatus arranged to afford considerable amusement to the player by the latter spinning a top and causing the same to travel over an inclined surface, leading at its lower edge to a depression, means being provided for counting the game.

Pertaining to Vehicles.

LAMP ATTACHMENT FOR VEHICLES.—T. L. RINEY, Center, Mo., and J. A. RINEY, Wymore, Neb. Means in this case are provided for detachably securing a lamp or lantern on the tip end of a vehicle tongue or draft pole, and thus dispose the lighting device in front of a team of draft animals connected with the tongue, whereby the light will be projected forwardly and near the ground and illuminate the roadway directly in front of the horses, so that the driver may inspect the road before it is traversed.

Designs.

DESIGN FOR A MUSICAL INSTRUMENT PEDAL.—H. SANDNER, Union Hill, N. J. In this case the pedal's extreme end is of round form, the top of which is ornamented with the design of a harp that about fills the area of the circle, and around the harp the surface is roughened or stippled.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Kindly write queries on separate sheets when writing about other matters, such as patents, subscriptions, books, etc. This will facilitate answering your questions. Be sure and give full name and address on every sheet.

Full hints to correspondents were printed at the head of this column in the issue of June 18th, 1910, or will be sent by mail on request.

(12309) H. E. W. says: I have a stream of perpetual flowing water that I can dam and get a fall of possibly 4 or 5 feet of about 500 gallons per minute. I want to raise the water about 60 feet for irrigation purposes. Under the above conditions, what would be the maximum amount of water I could get raised this elevation with a ram of the greatest capacity that would work with the amount of water and fall I have? A. Your proposed lift of 60 feet bears a ratio of 15 to the minimum figure of 4 feet suggested for the fall of water to the ram. The efficiency of the ram at this ratio of lift to fall would be about 30 per cent; that is, the net quantity lifted, multiplied by the height of lift, would be about 30 per cent of the product of the quantity run to waste by the fall. Putting q for the quantity you could lift to 60 feet, the wasted water will be $500 - q$; the product of quantity by fall is $2{,}000 - 4q$; and as $q \times 60$ is 30 per cent of this, $60q = 30/100\ (2{,}000 - 4q)$ and q is equal to 10 gallons per minute only. You will observe that with perfect efficiency you could raise only 1/15 of the water to 15 times the height of fall; so that unless you can increase the height of the dam, you will have very little water left.

(12310) F. L. & W. Co. says: Please advise if you think it would be practicable to use a 6-inch steam pipe 1,000 feet long to run a 150 horse-power engine. This steam line will be elevated about eight feet, covered with a good grade of asbestos, and also boxed if necessary. There will be a 2-inch tap from this line to run two dry kilns. The climatic conditions are hardly ever over freezing weather. A. You can figure on a loss of 1/3 to ½ horse-power of steam per hour per 100 square feet of well-covered pipe. This means using one of the best commercial grades of covering and a wooden box outside of it. As there would be about 1,730 square feet surface in your 1,000 feet length of 6-inch pipe, you would lose about 6 to 8 horse-power in the run, say 4 to 6 per cent of the whole. The figures are taken from data in Kent's "Mechanical Engineer's Pocket Book." Your line should slope toward the engine and be well drained at the engine end by a trap; and you should provide carefully for expansion, probably by one or more loops of bent pipe, rather than slip joints.

(12311) A. Z. asks: What will be the force expressed in pounds, developed by wheel 30 inches in diameter, the rim ¾ of an inch square, running at one thousand revolutions a minute, and at two thousand? Will six or eight spokes ¾ of an inch square at the rim, and tapering down to ⅝ of an inch at the hub, be strong enough to stand the strain of the centrifugal force developed by the rim at the above mentioned speeds? And what would be the best material to build these wheels from, either cast, malleable, or wrought iron? A. Designers do not generally rely on the spokes of flywheels to sustain any part of the centrifugal force; the rim should support its own strains. In cast iron, a rim speed of not over one mile per minute is considered safe. This would allow your 30-inch wheel a speed of 700 revolutions per minute. At this speed the strain would be: $0.0000284\ W$ and N^2 pounds on the rim section, or $0.0000284\ W \times 15 \times 700^2$; and as the ¾-inch × 30-inch rim in cast iron will weigh $¾ \times 30 \times 3.14 \times 0.26 = 18.4$ pounds, the expansion $0.0000284 \times 18.4 \times 15 \times 700^2 = 3{,}822$ pounds. As the centrifugal force of one-half of the rim is carried by the sectional area of the two sides of the rim, the load of 1,911 pounds is supported by $2 \times ¾ \times ¾$ or 9/8 square inch, making the strain per square inch about 1,700 pounds. At 1,000 revolutions the strain will be $\frac{1{,}000^2}{700^2}$ greater, or 2.430 pounds. At 2,000 revolutions the strain will be $\frac{2{,}000^2}{1{,}000^2}$ greater still, or 9,720 pounds. A malleable casting would seem strong enough for the 1,000 revolutions speed, but for the 2,000 speed we think the rim should be of wrought iron or steel.

(12312) P. C. C. asks: Would you kindly tell me if rooms in a house can be satisfactorily heated by hot air entering near the ceiling? The rooms are in the basement, on the same level as the furnace. Would it be better to excavate a little deeper for the furnace room, so that the hot air could enter on the floor level? Would also like to know which is the better way of drawing the cold-air supply—from some part of the house, which is usually done, or from the outside? In the latter case, the cold air in the room would pass out through open windows to give place to the warm air coming in. A. The problem of ventilating a house with natural draft in hot-air flues depends on such slight differences in pressure that it is generally best not to try any radical departure from usual methods. Unless you could provide some way to draw out the cold air from the floor of the room, we should not expect the service to be satisfactory if the hot air enters near the ceiling. It would be much better to go to the expense of sinking the furnace to a proper depth to allow of piping in the usual way, than to take chances with an experiment. The cold air for furnaces is generally drawn in part from outside the house on the sunny side, and in part from the house itself. By having two pipes in this way, and dampers in each, you can take air from the house over and over on the coldest days and from outdoors in warm weather. It might seem that reheating the house air would be very objectionable; but in houses as they are usually built there is plenty of leakage from outdoors on cold, crisp days to supply a sufficient amount of fresh air for ventilation. On warm days there is less window leakage, etc., and the outdoor connection should be used.

NEW BOOKS, ETC.

MACHINE DRAWING. By Gardner C. Anthony, A.M., Sc.D. Boston: D. A. Heath & Co., 1910. Oblong 12mo.; 104 pp. Price, $1.50.

There is hardly a week goes by that a new book on mechanical drawing does not come to the reviewer's desk. There is always room however for a really good book on mechanical drawing, and the one before us is an excellent one. The illustrations are on a good scale and are well executed. It has been the aim of the author to teach and encourage the use of concise graphic terms by adopting the idiomatic phrases of engineers, and to suggest many useful means for acquiring facility in this form of expression. To attain this end, numerous examples have been chosen from practice, with a view to obtaining the largest experience consistent with a minimum expenditure of time. These problems have received the severe test of use in classes of high schools, manual training schools, and technical colleges.

BRAZIL AND HER PEOPLE OF TO-DAY. By Nevin O. Winter. Boston: L. C. Page & Co., 1910. 12 mo.; 388 pp. Price, $3.

The publishers are to be congratulated on the admirable series of books which they are issuing on Central and South America. The author has made an excellent contribution to the literature of these southern lands in his "Mexico and Guatemala." The present volume, which is in the same series, deals with the customs, characteristics, amusements, history, and advances of the Brazilians, and the development and resources of their country. The book is accompanied by an excellent map, and the illustrations, which are printed separately and inserted, are both well selected and well executed. Some of the architecture seems very *baroque* to northern eyes, but is of course toned by the atmosphere of the country. The book is beautifully printed and is attractively bound. The end papers are worthy of special commendation, and show the care and attention to detail which the publishers are giving to these books.

BOHEMIA AND THE CZECHS. By Will S. Monroe. Boston: L. C. Page & Co., 1910. 12mo.; 488 pp. Price, $3.

This is a history of the people, institutions, and geography of the kingdom, together with accounts of Moravia and Silesia. It deals with an out-of-the-way part of the world, much of which is never seen by the American traveler. Its studies are thoroughly adequate, and deal with all questions regarding Bohemia. The part relating to Prague will be perhaps the most appreciated by American readers. The same author has written on Turkey, Norway, and Sicily, and has shown himself to be an excellent chronicler of manners and customs.

THE BOY AVIATORS' TREASURE QUEST; OR, THE GOLDEN GALLEON. By Capt. Wilbur Lawton. New York: Hurst & Co., 1910. 16mo.; 291 pp. Price, 50 cents.

We have on other occasions commented on the books of this series. The present volume does not lack interest for the young reader. Books of this kind will in time displace the dime novel of a decade ago.

THE LANDS OF THE TAME TURK; OR, THE BALKAN STATES OF TO-DAY. By Blair Jaekel. Boston: L. C. Page & Co., 1910. 12mo.; 295 pp. Price, $2.50.

This is an interesting narrative of travel through Servia, Bulgaria, Montenegro, Dalmatia, and the recently acquired provinces of Bosnia and Herzegovina, with observations on the peoples, their races, creeds, institutions, and politics, and on the geographical, historical, and commercial aspects of the several countries. There are numerous illustrations from photographs taken especially for the book, which is also elaborately illustrated by inserted engravings. The boiling, seething political caldron which this book describes is one of the spots which are little frequented by the traveler of to-day, so that perhaps the excellent map which accompanies it will not prove amiss. The book, like all the rest in the "Little Pilgrimage Series," is admirably made, the binding being particularly handsome, the coats of arms of the various countries on the cover being excellent.

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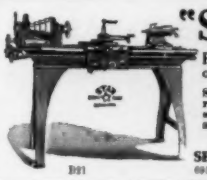

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OUR WASTED SEAWEED RESOURCES.

(Continued from page 336.)

low tide. Deep holes are made in the muddy floor of the bay by thrusting down through the water an elongated conical wooden frame, with two long upright wooden handles. Into each of these holes is placed one of the brush bundles, forming long rows that project above the water. These brush bundles afford a lodging place for the spores of the red laver, and they become attached to the twigs and develop into plants that grow rapidly, so that in three or four months they are ready to be harvested. They are cut from the brush, taken ashore in boats, washed, dried, and pressed into sheets. This product is known as "amanori." It is baked or toasted until crisp, and then crumbled in the hands and dropped into sauces, soups, and broths. It is prepared in various other forms, some very palatable, as well as highly nutritious, being rich in proteids. The red laver grows abundantly along both coasts of the United States. In Ireland this material is known as "sloke," and is served as a dressing for cold meat.

Of much greater importance than the preparation of amanori is the manufacture of "kanten," or seaweed isinglass, which is exported by the Japanese to all civilized countries. According to the Bulletin referred to, in 1903 there were in Japan five hundred establishments, turning out about 3,000,000 pounds, selling at about 25 cents a pound. It is prepared from seaweeds of the genus *Gelidium*. These grow on rocky sea bottoms, and are taken by diving, the season lasting from May to October. The seaweeds are dried by the gatherers, and sold to the kanten manufacturers at from six to nine cents a pound. The dried seaweeds are washed and bleached, and after boiling, they are strained and filtered, thus separating the gelatin from the other materials. Numerous other processes are necessary to turn out bar or square kanten and slender kanten. The manufactured product is pearly white, shiny, and semi-transparent. It is used in making jellies, soups, sauces, and (by the Japanese) in purifying *sake*, the native wine made from rice. In the United States it is employed chiefly in food preparations where gelatin is required, and is superior to the similar animal product. It is also used for the sizing of textiles, the stiffening of the warp of silks, the clarifying of wines, beer, and coffee, the making of molds for workers in plaster of Paris, and in the manufacture of paper. In all civilized countries the Japanese kanten, under the name agar-agar, is used exclusively as the culture medium in bacteriological work, by scientific investigators. This is a high tribute to the purity of the Japanese product. Large shipments of kanten are made to Holland, destined for the schnapps factories. Similar products were manufactured in other Asiatic countries, and are marketed under various names, such as agar-agar gum, agal-agal, Bengal isinglass, Bengal isinglass gum, Ceylon moss, Ceylon agar-agar, Chinese moss, etc.

The same species used in Japan for kanten is found abundantly along the Pacific coast of the United States, and at numerous points on the Atlantic coast. *Porphyra perforata* is a red seaweed that has been collected for many years along the shores of Ventura County, California, baled like hay, exported to China, there to be manufactured into Chinese moss products.

Funori, or seaweed glue, is prepared from many species of algæ, selling at from four to twenty-four cents a pound. It is employed for glazing and stiffening fabrics, as starch for clothing, for coating fine papers, cementing walls and tiles, and in the decoration of porcelain. A considerable quantity is exported to Europe for use in the sizing of textiles.

The most abundant of all seaweeds are the kelps, distributed along every coast line. From these the Japanese prepare "kombu," which enters into the dietary

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(*Continued from page 349.*)

of every family in Japan. It is used as a vegetable, made into confections, cooked with soups, fish, and meats, employed as a sauce, and made into a beverage. The coasts of the United States are abundantly supplied with kelps, which are used for fertilizing the adjacent lands, although in the shape of shredded or flaked seaweed, according to Mr. Hugh M. Smith, Deputy U. S. Fish Commissioner, they would yield us a palatable and nutritious food.

Iodine has been manufactured from the kelps for many years, and the price has been so reduced by the working of the nitrate beds of Peru, that its manufacture from kelps in the United States can be made attractive and profitable only by the utilization of the by-products, chloride of potash, algin, cellulose, dextrin, mannite, and numerous salts, such as sodium alginate.

Algin is a very remarkable substance, that seems capable of an indefinite variety of applications in the arts and industries. It has 14 times the viscosity of starch, and 37 times that of gum arabic. In the form of sodium alginate it can be made into thin, colorless sheets, resembling gelatin, but very flexible. With bichrome, algin becomes insoluble, and silver alginate darkens quickly upon exposure to light. As sizing for fabrics, algin supplies the long-felt want of a soluble gum of great elasticity and flexibility, and of a soluble substitute for albumen, which can be easily rendered insoluble and used as a mordant. Sodium alginate is said by experts to be the best preparation known for preventing the incrustation of boilers. As a food preparation, algin may be used for thickening soups and puddings, and as a substitute for gum arabic in making lozenges and jujubes. In pharmacy it has a place in the emulsifying of oils and for refining spirits.

Off the Alaskan coast and among the Aleutian Islands is the *Nereocystis lutkeana*. On the surface of the water floats a barrel-shaped air vessel, six or seven feet long, from which grows a mass of foliage consisting of forty or fifty fronds, each one of which may be from 30 to 50 feet in length. The whole floating mass is anchored by a slender, cord-like stalk that is attached to the rocks far below. This anchor line frequently exceeds 300 feet. A related plant, the *Macrocystis*, is said to sometimes exceed 1,500 feet in length, anchoring a floating mass of vegetation hundreds of square yards in area.

Identical with the *Nereocystis lutkeana* in everything but size is the curious plant called the giant seaweed. After a storm the tides often cast hundreds upon the beaches. The air vessels are round, sometimes eight or ten inches in diameter, and commonly connected with its cord-like anchor line by a thick tubular prolongation several feet in length. Other forms of marine vegetation growing in great abundance along the western coast are the *Phyllospora*—a cartilaginous strap of great length, densely clad with fronds and air vessels, and the so-called iodine kelps.

All these abundant kelps are rich in algin, iodine, and proteids. It is amazing that such vast resources, rich in materials for which there is a constant demand, are permitted to grow and decay without any attempt to turn them to economic account.

However, the United States has one seaweed industry of commercial importance in "Irish moss," a form of alga that grows abundantly along the Atlantic coast, particularly north of Cape Cod. The center of the industry is at Scituate, Mass., where it has been prosecuted for three-quarters of a century. The average annual output at present is about 800,000 pounds, valued at $25,000. It is used chiefly for making blanc mange, and is also employed in cough remedies, in making jellies and puddings, in clarifying beer, and in sizing fabrics.

Vast harvests of the sea, as represented

by the algæ that grow to maturity and then decay along our extended coast lines, are wasted. They are capable of adding tens of millions to the wealth of the nation, of supporting numerous industries that would give permanent and remunerative employment to many thousands of people, of supplying an abundance of cheap and wholesome food products, and of relieving American manufacturers from dependence upon foreign sources of supply for numerous chemicals and other materials used in various arts and industries.

THE WELLMAN OCEAN AIR TRIP.

(Concluded from page 341.)

in the balloon had been wasted. There was every probability that the airship could keep afloat throughout the day, but the chances of staying in the air at night, when the reduced gas supply in the envelope would be condensed by cold, were rather slim. Furthermore, there was the difficulty of launching the lifeboat with the heavy equilibrator trailing in its wake, and it seemed far more prudent to undertake to launch the boat while a vessel stood by ready to give assistance.

The problem of launching the boat was no small one. The airship was drifting broadside to the wind at the rate of fifteen knots. This meant that the boat, which could not be swung athwart the car, would have to be launched sideways. The valves were opened until the boat dropped to within four feet of the water. All the materials that were saved from the airship were stowed in the bottom of the lifeboat to serve as ballast. At a given signal the automatic shackles which held the boat to the airship were released, and the boat dropped into the sea. Despite the fact that it was traveling broadside at a rate of fifteen knots, it did not ship a gallon of water. As soon as the balloon was released of this weight, it shot up into the air, and the equilibrator was whipped out of the water, striking the boat and crushing the forward air compartment, fortunately above the water line. Before cutting loose from the airship, Mr. Vaniman tied a heavy can to the gas valve, so that the balloon would lose its gas, thus obviating any danger of its rising out of the sea and acting as a menace to the rigging of vessels or to buildings along the coast. When last seen, the balloon was settling, nose down, into the water.

Thus ended one of the most remarkable voyages ever undertaken, and certainly the most remarkable rescue at sea. The results accomplished were two records for dirigibles; one of duration, which consisted of 71½ hours in the air as against 36 hours, which was made by Zeppelin, and the other of distance, which was put at 1,008 miles by Navigator Simon in his log book, the previous distance record having been made by Zeppelin when he covered 800 miles without coming to earth. However, the object of the expedition was not to establish records. The underlying idea of Mr. Wellman and Mr. Vaniman has been to stimulate interest in dirigible balloons, to study their behavior under varying conditions, and to promote their development. It is a wonderful tribute to the skill of the engineer who designed Mr. Wellman's airship that on its first voyage, without any preliminary trial, it broke all previous records and, as far as the machinery is concerned, with the exception of the one defective engine, maintained every part intact. Not a stay was broken, and not a nut needed to be tightened during the voyage.

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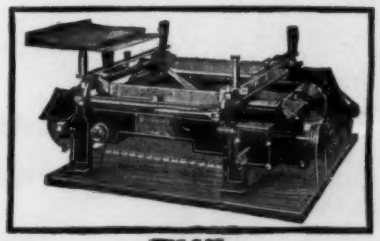

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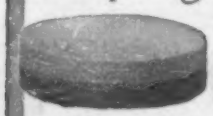

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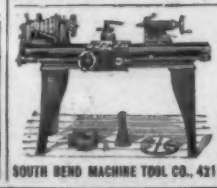

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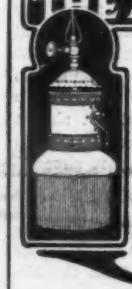

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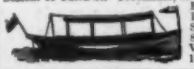

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